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TRANSACTIONS

OF THE

Ophthalmological Division

OF THE

American Academy of  
Ophthalmology and  
Oto-Laryngology,

AT ITS

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# VICE-PRESIDENT'S ADDRESS.

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## EXPERT TESTIMONY AS IT RELATES TO OPHTHALMOLOGY.

BY DERRICK T. VAIL, M.D.,

CINCINNATI.

*Mr. President and Fellow Members:*

Expert ocular testimony implies, in the first place, an accurate and detailed knowledge of the science of ophthalmology, coupled with abundant practical experience, and in the second place a complete understanding of the plaintiff's ocular condition.

For an expert to diagnose and treat an ophthalmic case in routine practice entails only a moderate amount of time, for much of the tedious work, such as taking the visual fields, testing the ocular muscles, etc., is well done by trained assistants under his supervision; but the examination of a case with a view of furnishing evidence entails the expenditure of a great deal more time on the part of the oculist himself, for the clinical reports furnished by assistants amount to only hearsay evidence and will not be admitted. It is therefore our duty to conduct this examination personally and with consummate care. We may be asked while on the stand to state the details of our examination step by step. This is done in order to find if some detail has been neglected. The hurried and incomplete examination of the plaintiff's eyes is sure to be exposed in glaring exaggeration before the jury to the detriment of the expert.

The habit of examining a case in a cursory manner is apt to lead to a wrong diagnosis, and even an expert of undoubted ability will be led to honestly testify to a false state of affairs. To illustrate: A man brought suit against a railroad company to secure damages for alleged personal injury, the result of an accident which he claimed was due to the company's negligence. He claimed his vision was injured, paralytic ptosis present, and that there were other signs of oncoming blindness. An expert oculist substantiated his claim on the witness stand.

Another oculist, not knowing about this evidence, testified that the impairment of vision was due to a slight pannus, and that the ptosis was entirely inflammatory; both being due to chronic trachoma, which was present and which must have existed many years prior to the accident. The former oculist was led to testify falsely because he had evidently *failed to evert the upper lid* in his examination of the eyes.

We should make it a rule to examine every tissue in its natural turn before going on the stand to testify. The frequency with which malinger exists in the cases of personal damage suits should put us on our guard. An element of exaggeration of symptoms exists in many of the ophthalmic cases which come to us for treatment, but in the personal injury cases it is usually much greater.

There is no class of cases which calls for greater perception and skill in diagnosis than these cases of simulation. In many of the cases of marked exaggeration of symptoms, there exists a real injury, of slight significance perhaps, and it is just to allow the plaintiff the benefit of an admission that the injury exists and an honest statement of what it amounts to.

Excellent works on visual economics are to be had, wherein we find working formulæ for estimating the amount of pecuniary compensation which is just in nearly every case. In the cases I have been called on to testify, my opinion regarding pecuniary compensation was not asked. I have thought that the reason was that that was the province of the jury to decide.

I wish now to speak of some of the disagreeable features connected with expert testimony. One is that if you have distinguished yourself on the witness stand as an expert, you are apt to be called to testify in all sorts of ophthalmic cases. This will result in positive injury to your reputation. You stand in danger of being considered a court hanger-on, and are judged ready to serve as an ideal witness on whichever side engages your services first. This is a disagreeable feature, being absolutely unjust.

Another disagreeable feature is that your evidence may run entirely counter to the interests of the side employing your services, and as you must look to the party subpoenaing you for your fee as an expert, you feel diffident about pock-

eting the man's money after testifying against him. If the court would but order the examination, and pay for it out of the court costs, it would do away with this unpleasant feeling.

Another disagreeable feature that occasionally arises, is that some one of your colleagues has been summoned on the other side and has given testimony the exact opposite of yours. In such a case you may be asked your opinion regarding him and how he stands in the profession. You take pleasure in lauding your confrère, but in so doing depreciate your own testimony and appreciate his. Your duty is to speak well of anyone who is in good standing in the profession, even if your own testimony must suffer. This is sometimes, though rarely, a disagreeable feature.

In giving your testimony you should use language comprehensible to the most illiterate jurymen, and your answers to questions should be short, unequivocal, honest and frank. There should be no attempt to display knowledge or skill: the short, plain and polite answer to a question is the best passport to the good opinion of the court and jury. An expert who has made a thorough examination and has learned the exact ocular condition of the plaintiff has nothing to fear from cunning or pugnacious lawyers.

Sometimes an expert is called on to explain or elucidate ophthalmic matters. He does not testify regarding the plaintiff, for he has not examined him, and yet the hypothetical questions which are asked bear directly on the case before the jury. It is best to regard the hypothetical question in a broad sense, for by so doing the answer will be qualified to meet any exigency which may arise in the cross-examination. Occasionally you will be gratified to see that your testimony has given satisfaction to both plaintiff and defendant. In such a case I was once doubly gratified, for I received a fee for expert testimony from each side.

And finally, I would say a word regarding a fourth party which is involved in every case. So far I have referred to but three interested parties, viz.: the Expert, the Court of Justice and the Contestants at Law. There is a fourth—our Great Specialty. Every expert is regarded as an exponent. See to it that you bear yourself in such a way as to incite honor and respect for Ophthalmology.

# ESSAYS AND DISCUSSIONS.

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## THE LENS-CAPSULE IN THE OPERATION OF CATARACT.

BY HERMANN KNAPP, M.D.

NEW YORK.

THREE recent publications have determined me to accept your president's invitation to read a paper before the Academy of Ophthalmology and Oto-Laryngology. The first is a remarkable and important discussion on "Capsular Complications After Cataract Extractions," at the Ophthalmic Section of the British Medical Association, August 26, 1905, in the *British Medical Journal*, p. 433. The discussion was introduced by E. Treacher Collins. The Journal has only an abstract of the paper, which deals with the difficulties that are caused through the lens capsule, under two heads:

I. *By entering into the section wound*, where it retards the closure of the wound and induces the most deleterious consequences, first causing an uneven, irritable scar, which draws the iris into its proliferating intumescence, develops into kerato-irido-cyclitis, and finally into a chronic sero-plastic uveitis, ending not only in the blindness of the operated eye, but also of the other by sympathetic ophthalmitis;

II, *By opacifying in loco*.

Mr. Collins grounded his remarks on specimens of three cases of severe irido-cyclitis, of which two had degenerated into sympathetic inflammations of the fellow eye. In all three cases the sections showed thickening of the sclera-corneal tissue in the vicinity of the wound by infiltration with round-cell exudate. The conjunctival flap was elevated, due to the cell infiltration beneath it, and there was a large accumulation of cells surrounding the entire capsule, with some giant cells.

The simple agglutination of the capsule into the wound is frequent and produces only a mild irritation with slight thick-



ening of its site. It may cause glaucoma by drawing the iris forward, and occupying the angle. In almost all cases of combined extraction, adhesions of the iris stump to the scar have been found in the eyes that have been examined under the microscope (O. Becker). These adhesions drag also the adjacent apices of the ciliary processes into the common scar,—a swampy gutter, filled with pabulum for those foulest parasites so eagerly hunted and never caught.

*How is this condition to be avoided, if it cannot be cured?* It is well known—and the late professor Arlt, one of the best known cataract operators, told me so forty years ago—that sympathetic ophthalmia is much rarer in simple flap operations than in Graefe's method. I can confirm this. When I made the old flap extraction I lost cases by infection, but none that drew the fellow eye into this awful calamity. During my practice in New York I remember two cases of loss by sympathetic irido-choroiditis after Graefe's operation. One has remained vividly in my memory because the most unfortunate consequences followed the operation. At that time I made a miscellaneous division of the centre of the capsule, "scratching," say our fellow eye surgeons on the other side of the ocean. There were little cataract remnants, capsule shreds, and probably also some iris in one small deposit near one of the angles of the section. The old gentleman, gouty and debilitated, suffered a great deal. He was visited daily by his wife and daughter, who were much distressed. I treated him very carefully. He was a good patient, and was six to eight weeks in the hospital: but when he felt certain that he would remain blind in both eyes, he drowned himself in his bath tub. Since I have adopted the method of opening the capsule peripherically, and parallel to the corneal section, and omitting the iridectomy, I have not seen a trace of sympathetic ophthalmia.

When this peripheral opening is correctly done, I have prolapses of the iris, which I cut as soon as I see them—that is, the day after the night in which they occur. This is mostly in the first night. If a prolapse is cut before any agglutination has taken place, the coloboma is easy and clean. The other methods of opening the capsule do not give so much protection from incarceration.

Allow me to discuss these other modes of opening the capsule. Two years ago Major Herbert, eye surgeon in Bombay, came out with a very useful little book on the technique of extraction of cataract. He criticised my peripheric splitting. He made light of it, saying that this splitting at the upper border of the lens behind the iris, where we cannot see what we do and the lens will escape only with great difficulty, condemns it at once. I reviewed his book and recommended it earnestly and heartily, because it contains many very practical hints and advices, rules which the orthodox text-books ignore. In cataract operation, the least technical trifle that serves a point ever so small should be duly appreciated. In my review of Major Herbert's monograph, with all the just praise, I had to take exception to his manner of opening the capsule, which is by a vertical slit from the lower point of the dilated pupil to the upper. This is the capsule opening I knew long ago. I do not criticise it by deductive argument, but by dry and hard experience. Von Graefe, my teacher, did that splitting during my studies in his hospital. At that time I was not quite a tyro in ophthalmology; among my apprenticeships I could count a year in London at the old Moorefields with Bowman, Critchett, and others, where I seldom missed a day.

The vertical splitting is unfavorable for the exit of the lens; the horizontal, parallel to the corneal section, offers its easiest escape. The iris is no appreciative hindrance. The next and worst drawback of the vertical splitting is that it produces a more or less dense scar, which is much in the way of the light and which is very unpleasant to divide by a later capsulotomy. Graefe made not only a vertical split in the capsule, but also a horizontal one at the periphery of the coloboma.

He opened the capsule horizontally in the upper part with a cystotome, which he then turned and with it ripped the capsule from below upward to meet the horizontal incision. In this way he obtained a broad, T-shaped opening, which did not always remain large enough, and my imitation of this procedure in Heidelberg and New York proved no more obliging. The peripheric single opening leaves a fine scar near the upper margin of the capsule. The latter is left in-

tact in all the other parts, and is most favorable for a secondary splitting with a sharp, well proportioned knife-needle. The opening crucial or T-shaped, remains almost always permanent. Every now and then some of my patients who have been operated that way fifteen to twenty-five years ago, come to show me their eyes. They are ideal, i. e., no disfigurement at all, clear, black pupil, T and S normal, and the patients say they never have any trouble with their sight.

Let me still consider two other modes of opening the capsule. The older one is to "scratch" the centre of the anterior capsule in different directions with a cystotome, curved needle, or fine hook. This was the general method of Arlt, in Vienna, and many others 40 to 75 years ago, and it is still practiced by many competent operators. Years ago I went through the eye clinic in Vienna, where Prof. Arlt showed me one of his patients. He had often been in my clinic at Heidelberg, and at times he performed some cataract extractions when he was asked by the members of the German Ophthalmic Society at the yearly conventions.

I showed him cases with peripheric capsule opening, and told him that this was a feature of the cataract operation, because it was almost always free from synechiæ. He said he had none either after central and miscellaneous discision. I expressed my doubt. He said, "I shall convince you if you come to Vienna again." It was not long after that I went to Vienna, and he showed me all the cases operated and asked me to inspect the pupils with oblique light myself. I did so and told him: "There is no free pupil: all have fine adhesions." "Oh, yes," he replied; "those are delicate agglutinations, not inflammatory products. They do not impair the sight, and signify nothing." I soon detected the cause of these innocent agglutinations. In watching the passage of the cataract through the narrow pupillary area, I saw small ruptures at the border of the pupil. They were little angular ruptures, well visible so long as the white lens was their background; as soon as the lens is out they contract and cannot be seen any more. In some eyes there are no adhesions, but many show the small synechiæ. Their creation, so far as I can explain it, is as follows: When the capsule is ruptured miscellaneously its small shreds come in

contact with the tiny, irregular ruptures of the iris and agglutinate. When the capsule is incised away from any rupture of the sphincter portion of the lens, the two wounds do not meet, but close separately. When in a month or later the capsule is discinded with the knife-needle, the shreds of the capsule do not touch a ruptured place, and the pupil remains with very few or no synechiæ, constituting an ideal pupil.

The next mode of opening the capsule is to tear a central leaflet from the anterior capsule. This mode is very commendable. About five years ago, on a journey from Egypt to Vienna, I stopped in Buda-Pesth and visited the University Eyeclinic, which at the time was in the care of Professor Schuleck. I knew from his publications and hearsay that he was an excellent operator. In the hospital were about a dozen patients operated for cataract. Schulek showed me all, let me examine them myself, and he operated, by Graefe's combined extraction, two patients before me. The operations were without accident, and the patients previously operated on were in the best way of recovery. This mode of removing cataracts is very commendable.

When the combined extraction had become popular, and I had in Heidelberg a fairly large opportunity of operating cataracts, I saw that the capsule was the most difficult factor in the cataract operation. In one of the periodical statistical reports of my cataract operations, I said: "The man who invents a safe method of removing the central part of the anterior capsule will be the greatest benefactor of the hosts of countless old blind people." If in the combined operation the capsule is removed, success is almost certain, provided there are no complications on the part of the eye and no coarse technical faults. Yet there are also difficulties in the removal of the central part of the anterior capsule. It is mostly done with a capsule forceps, the teeth of which are sharp and bent somewhat backward. The accidents to which this is open are chiefly the dislocation of the lens with prolapse of the vitreous and its consequences. Hard capsules do not yield, so that the whole cataract comes out with the capsule, which as a rule gives excellent results. Professor Fuchs in Vienna is a great advocate of this method.

Another drawback inherent to this method is the necessity of an excision of a piece of iris: otherwise it is too hazardous to manipulate in the narrow pupillary space. I have devised a peculiar capsule forceps (about twen years ago), according to the principle of the nautical grapple-hook. When the branches of the forceps are opened their claws are directed obliquely towards the capsule, and when the forceps closes it grasps the central part of the iris and removes it, when it is withdrawn. I have not used this forceps so much as I might have. The reason was that the tearing of this piece of capsule may dislocate the lens, and leads to prolapse of vitreous when the lens is expelled. Apart from that it produces not a permanent clear way for the passage of the rays of light, as the posterior capsule will opacify, too, by wrinkling and dotting, so that patients who had very good sight in the first three to six months notice, without pain or discomfort, a gradual deterioration of sight, which, however, can be permanently corrected by a second discission.

## ON PINGUECULA AND PTERYGIUM.

BY ADOLF ALT, M.D.

WHEN in 1875 or 1876 Professor Horner of Zürich announced it as his opinion that the little innocent looking tumor known by the incorrect name of pinguecula, was the origin of the very much more important form of tumor, known as pterygium, this idea was looked upon as wholly visionary and even ridiculous.

Arlt's views concerning the formation of a pterygium were in those days the governing ones.

It so happened that in 1876 I had the good fortune to obtain an eye with pterygium, and Goldzieher had the same good fortune a year or two later. Our examinations led to very similar results and seemed to prove that, as a rule, the formation of pterygium took place in accordance with Arlt's ideas. As you know, he assumed a peripheral corneal ulcer which was covered by an inflamed fold of neighboring conjunctiva. An agglutination of the two tissues was followed by a dragging or growing inward of the conjunctival tissue into the cornea, as the ulcer progressed toward the center of the latter membrane. In my specimens Bowman's layer was detached at the periphery and folded on itself, hook shape, as if the conjunctiva, growing into the cornea beneath it, had dragged its periphery along with it. But the most convincing condition was that under the conjunctival tissue a large cavity was found filled with degenerated and degenerating epithelial cells, which appeared to be incarcerated conjunctival epithelium. From these results of my examination I considered Arlt's views proved, in so far that this was at least one way in which a pterygium might originate, and I must still believe this to be true, if only in exceptional cases.

This was, of course, contradictory to Horner's opinion. But in the light of much further experience I can only wonder that in those days not one of the many excellent clinical observers seems to have known of a direct connection between pinguecula and pterygium, and not one, as far as I remember, brought forward any facts in support of Horner's statement.

The few pingueculæ which I had had occasion to examine histologically before writing my book on the histology and pathology of the eye, were stained in the inferior manner of those days and gave me the impression that a pinguecula consisted of the very much condensed fibrous tissue of the conjunctiva and a hyperplasia of the conjunctival epithelium of such a degree that I could only compare it to an epithelioma. While it is now an established fact that there are such pingueculæ in which the hyperplasia of the epithelium is very pronounced, they seem to be rather exceptional forms.

Both pinguecula and pterygium have since been carefully studied by a number of investigators. Fuchs' work on these subjects is, perhaps, the best known and most generally adopted, although after him Sgrosso, Schulek, Huebner and others have also made careful investigations with results which vary in some points considerably from Fuchs' views.

In speaking of pinguecula, Fuchs states: "The pinguecula consists of a thickening of the conjunctiva due in the main to a *hyaline degeneration* of the connective tissue elements and deposits of free hyaline. The causes producing such a degeneration are the senile alterations of the tissues combined with external noxious influences. The same noxious influences lead in the corneal tissue to a similar hyaline degeneration, as for instance, in arcus senilis (which seems to be wrong), ribbon-shaped keratitis, and yellow spots in old corneal scars. Another important change at the site of a pinguecula consists of an extraordinary increase in number and volume of the *elastic fibres*."

Sgrosso, agreeing in the main with Fuchs, thought that we must distinguish between an episcleral and a conjunctival pinguecula, and he further assumes two subdivisions of the conjunctival form, namely, an epithelial and a connective tissue pinguecula. He seems to have met with an inordinate number of the epithelial variety.

The more recent and important work on pinguecula is that of Huebner. He found as the almost uniform histological characteristics of pinguecula a degeneration of the tissue elements of the conjunctiva in the whole area of the pinguecula. The participation in this degenerative process by the different tissues varied greatly in different specimens.

He found in the main that the tissue of the conjunctiva proper undergoes a hyaline degeneration. This hyaline tissue seems to become compressed and forms under the epithelium a band of varying thickness without nuclei and blood vessels, almost without structure. The tissue beneath this hyaline band consists of innumerable oblique and transverse sections of elastic fibres. He concludes that the elastic fibres which normally occur in the conjunctiva and subconjunctival tissue, become hypertrophied, grow longer and thicker, even ten to twenty times their normal thickness, but he finds no proof of any new formation of elastic tissue. In the hyaline tissue free hyaline is formed in the form of smaller or larger concretions which give the characteristic hyaline stains; in the elastic tissue he finds other droplets and larger concretions which give the characteristic stains of elastine.

Fuchs gave great importance to the hyaline concretions. Huebner cannot agree with him.

The tissue which according to Huebner takes the least part in this process of pinguecula formation is the epithelium, although it is sometimes thicker than normal. Yet, in two cases he found an enormous increase in thickness of the epithelial layers with formation of cell cylinders and buds growing into the depth and accompanied by the well known epithelial pearls, just as we are wont to see it in cases of true epithelioma.

While Huebner thus in a general way agrees with Fuchs, he points out that this author has laid too much stress on the hyaline degeneration of the conjunctival tissue and too little on the degenerative processes in the elastic tissue. It seems as if Fuchs might with propriety say the reverse of Huebner.

As regards a connection between pinguecula and pterygium, Fuchs does not doubt that a pterygium emanates from a pinguecula. Huebner, on the contrary, denies all connection between the two as totally separate processes. In order to explain the manner in which a pinguecula may grow into the cornea and produce a pterygium, Fuchs assumes a "histolytic influence" exerted on the corneal tissue and a peripheral atrophy of the cornea which would produce some form of chemotaxis. He does not accept the opinion of Arlt, and has never seen a corneal ulcer at the head of a pterygium.



Yet he, as well as Sgrosso, speaks of a subepithelial scar formation at the apex of the pterygium, and by it explains the whitish gray line usually seen in that locality.

According to all descriptions, the tissue of the full grown pterygium is that of the conjunctiva pure and simple, and its folds and nooks are covered with conjunctival epithelium. That is, a pterygium in a somewhat advanced stage can histologically hardly be brought into connection with a pinguecula. This is a well known fact, yet, like Fuchs and others, I have clinically seen in quite a number of cases, how a pingueclua would grow nearer and nearer to the corneoscleral margin and finally overstep it and creep on upon the cornea and form a pterygium: and I am also convinced, as we shall see, by histological examination that this is the usual, though, perhaps, not the only manner in which a pterygium is formed. In spite of the great many pingueculæ which we meet with here in America, it is comparatively rare that we have an opportunity of seeing the intermediate stages, since patients pay no attention to a pinguecula and are alarmed at a pterygium only when it has grown so far that it reduces their field of vision, and often not even then.

I have, therefore, when collecting material for my studies, made it a point to get specimens of the intermediate stages, of beginning, not grown, pterygia in order to learn something more about the connection between pinguecula and pterygium. From my examination of this material I have become more convinced than before that a pinguecula is, as a rule, the origin of a ptergium, although I must assume from my own first case of pterygium and from Goldzieher's that once in a while a pterygium may result from a peripheral corneal ulcer in the way Arlt explained it.

As regards pinguecula pure and simple, the results of my more recent examinations agree with those of the previous investigators, but I find that it would be incorrect to claim special prominence for any one of the different degenerative processes described as of more particular importance by several of them. The larger the number of cases examined, the more the apparent differences dwindle out of sight and a general average can be struck.

Thus I found that in most cases of pinguecula the epi-

thelium is of normal thickness or nearly so. In other cases it is in places or *in toto* atrophied. In others, again, there is a decided hyperplasia of the epithelial cover, while some rare cases, as I have stated before, the epithelial hyperplasia is such that it gives the exact picture of an epithelioma,

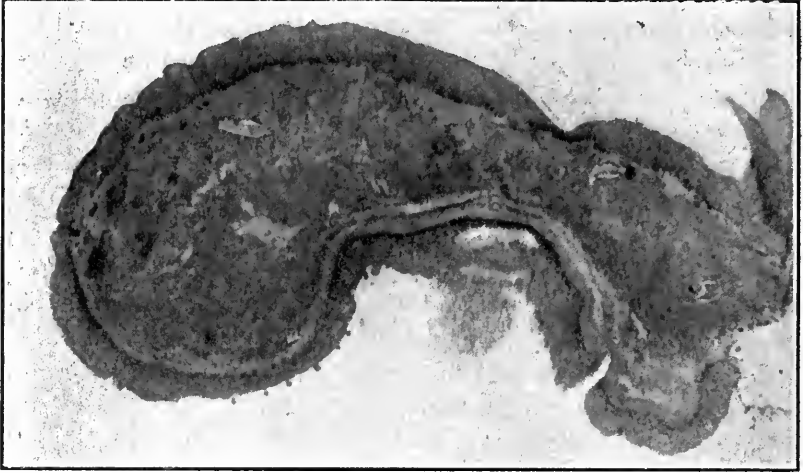


Fig. 1.

Pinguecula showing epithelium of varying thickness; under it is a light, narrow band of hyaline tissue and numerous hyaline concretions. The bulk of the tissue is made up of elastic fibres.



Fig. 2.

Pinguecula with enormous epithelioma-like hyperplasia of epithelium.

minus an infiltration zone, and can hardly be distinguished from it. In fact, I believe now that a case of epithelioma in a boy, which I published a number of years ago, may have been just such a pinguecula. (See Figs. 1 and 2).

Most investigators mention in particular that the conjunctival epithelium in their cases was especially rich in goblet cells. I have not found that this is a very striking feature in my specimens.

The hyaline degeneration of the conjunctival tissue is always present and this band of hyaline tissue appearing in sections at right angles to the surface may be comparatively thin and look very much like Bowman's membrane, or considerably thicker. In most cases its thickness varies in different parts of the same specimen.

In nearly every specimen, smaller and larger concretions of varying shape are found embodied in it or near it, especially on the side toward the cornea. These are deposits of free hyaline and do not differ in appearance and shape from those found in the corneal tissue in old scars. The variety in shape is evidently due to the pressure exerted upon them by the surrounding tissue during their formation.

Underneath this hyaline tissue lies one which with a low power appears granular, almost like detritus. With a high power it is seen to consist of innumerable fibres cut at right angles or obliquely, hence the granular appearance. By means of the proper staining material—I had the best results with Weigert's elastine stain or orceine, but even eosine will do—the fibres can better be recognized and their character as elastic fibres is affirmed. They are much thicker and longer and wavy than the normal elastic fibres. They further undergo a degenerative process which leads to their breaking up and to the formation of similar concretions as those found in the hyaline part. They appear at first in small particles like dust, which gradually coalesce to form the larger conglomerates. I cannot satisfactorily make out whether this mass of tightly compressed and interwoven elastic fibres is solely the result of a hypertrophy of the normally present elastic fibres or whether a new formation of elastic tissue takes place. (See Fig. 3).

Thus far we had to deal with purely degenerative changes in the conjunctiva and subconjunctival tissue. The picture is changed when we come to examine a beginning pterygium. Here I nearly always find that the pinguecula is preceded in its onward march toward the cornea by a dense connective

tissue which is rich in cells and which gradually merges into the corneal tissue. At the corneo-scleral juncture the epithelium is usually considerably thickened and instead of the epithelial papillæ normally found dipping into the underlying tissue at this place, I find the epithelial layer thrown outward into a fold in the hollow of which very frequently free hyaline is situated. This gives the impression as if the dense connective tissue during its growth toward the cornea dragged the pinguecula after itself in the same direction. This dense connective tissue takes its origin undoubtedly



Fig. 3.

Showing the hypertrophied elastic fibres, and a narrow hyaline band with a great deal of free hyaline beneath the epithelium.

from the pre-existing conjunctival tissue lying between the pinguecula and the corneo-scleral margin, and seems to me to be the important link between the pinguecula and a pterygium. Evidently the presence of the degenerated tissues of the pinguecula acts like a foreign substance and produces a slow inflammatory reaction in the tissue which severs the pinguecula from the corneal margin. (See Figs. 4, 5 and 6).

A further evidence of an inflammatory process, be it ever so slow, I found underneath the corneal epithelium. Bow-



Fig. 4.

Beginning pterygium. To the left, pinguecula; to the right, the newly formed connective tissue under the folded epithelium.



Fig. 5.

The same as Figure 4, from another case.

man's membrane in the norm begins at the very corneo-scleral juncture. When a pterygium is forming, it begins some distance from this point toward the center of the cornea and always some distance further in, than where the

apex of the pterygium lies. That is, its peripheral part has disappeared and is disappearing *pari passu* as the pterygium progresses into the cornea. The cause of this melting away of Bowman's membrane is best seen in early stages of pterygium formation. Here I find numerous leukocytes lying at the site of Bowman's membrane and penetrating into the corneal epithelium. Their action evidently has destroyed it. They are found lying in rows and heaps at the former site of Bowman's membrane and in the basal layer of



Fig. 6.

The newly formed tissue under a higher power. Concretions of elastine.

the epithelium they are seen in the shape of the well known "Entzündungsspiess" (inflammatory spears). (See Figs. 7 and 8). These leukocytes probably have emigrated from the few small blood vessels which always grow into the corneal tissue in front of the apex of a pterygium.

Thus it seems evident that at the time when a pinguecula gives rise to the formation of a pterygium, there is no peripheral corneal atrophy in the sense of Fuchs' description and no superficial ulcer in the strict sense of Arlt's opinion, but a very similar process with tissue death which goes on in the anterior layers of the corneal parenchyma, in Bowman's

membrane and the basal layer of the corneal epithelium, which might be termed an internal ulcer and which opens the way for the conjunctival tissue to grow in between parenchyma and epithelium.

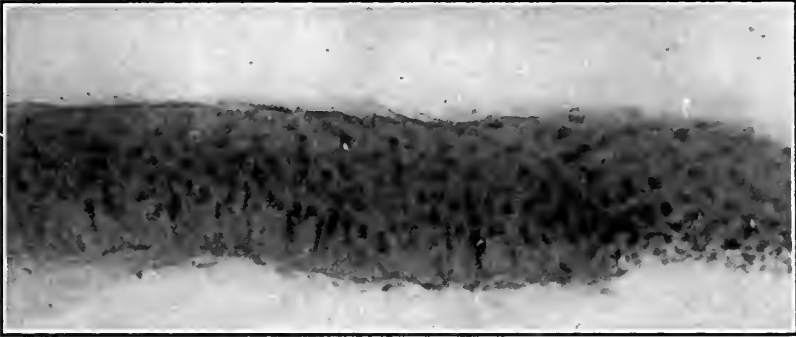


Fig. 7.

Corneal epithellum from beginning pterygium. Leukocytes in basal layer.



Fig. 8.

A similar condition under a higher power from another specimen.

As the pterygium grows further into the cornea the characteristic features of the pinguecula, as a rule, are gradually lost while the contraction of the newly formed tissue drags the conjunctiva more and more into the cornea. Sometimes, however, the pterygium may have grown for quite a distance into the cornea and still some of the hyper-

trophied elastic tissue may be found near its apex in some of the sections. (See Figs. 9 and 10).

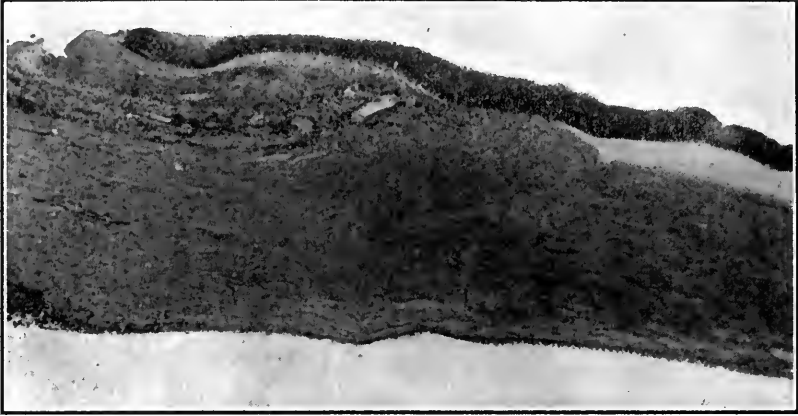


Fig. 9.

Apex of a pterygium with remnants of elastic fibres at the very apex.

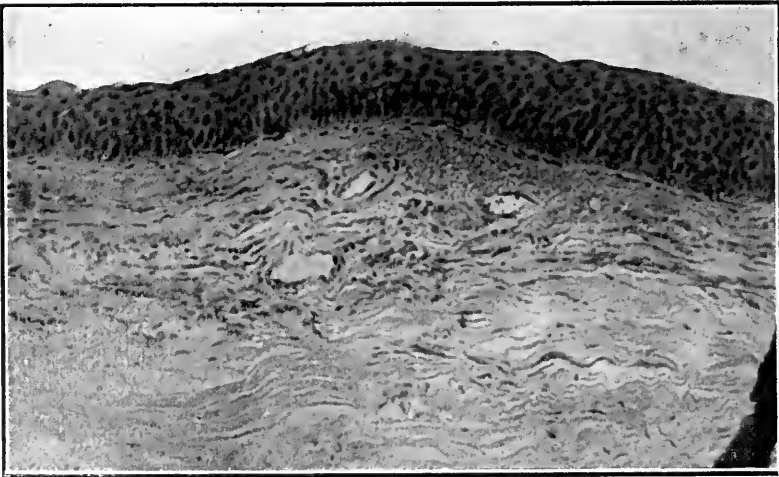


Fig. 10.

Apex of the same under a higher power. The granular tissue is composed of elastic fibres.

I have specimens of another case of beginning pterygium in which the tumor seems to be made up almost solely of elastic fibres. At the corneo-scleral margin where Bowman's membrane should begin in the sections the elastic tissue seems to grow directly into the cornea between epithelium and corneal parenchyma preceded by a few small blood vessels.



I took this eye from the corpse of a negro in the dissecting room and had not seen the man during life, yet the appearance was exactly that of a pterygium internum not far advanced beyond the corneo-scleral margin. (See Figs. 11 and 12)



Fig. 11.

Apex of beginning pterygium consisting chiefly of elastic fibres.

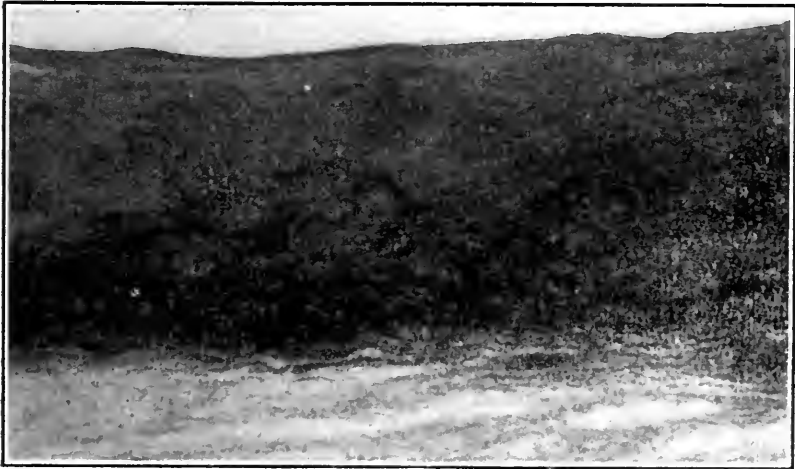


Fig. 12.

The same, further back from the corneoscleral margin.

After all this, it seems to me that the connection between pinguecula and pterygium is no longer as mysterious as it used to be, and we may assume it as certain that in most cases a pinguecula has been the first step to the formation of a pterygium, which does not by any means say that every pinguecula must form a pterygium. Given the necessary conditions, the presence of a pinguecula leads to a slow inflammatory process in the conjunctival tissue which separates it from the corneo-scleral margin, with new formation of tissue. This newly formed tissue, preceded by some small blood vessels, grows into the cornea between epithelium and parenchyma in the place of Bowman's membrane which is destroyed in advance of the oncoming head of the pterygium by an army of leukocytes. The newly formed tissue drags the pinguecula, and the conjunctiva on the other side of it, along in its growth toward the centre of the cornea, and the characteristic tissue of the pinguecula is gradually lost.

The idea that bacteria might figure in the progress of the tumor in the cornea, which I shared at one time with Panas and others, must, I think, be abandoned; at least I have never been able to find any.

Having, perhaps, tired you by this pathological paper, and in order to give you more material for discussion, I just want to add a few words as to the simplest operation for pterygium, the one which I prefer to avulsion, electric cautery destruction, transplantation and all other methods.

Having removed the apex of the pterygium as cleanly as possible from the cornea and excised a rhomboid piece of conjunctiva in the well known old fashion, I make a free cut through the conjunctiva at the limbus upward and downward so as to relax this membrane perfectly. I know that Dr. Savage described these cuts in his operation, but I have made them years before his publication and did not think that I was the only one to whom the value of such relaxing incisions had occurred. After this I cauterize especially the corneal wound vigorously with pure carbolic acid, apply no sutures and close the eye. In several hundred cases of pterygium thus operated upon, I have met with very few relapses.

It seems hardly worth while to say that I much prefer, if the patient will allow it, to remove a pterygium at its very beginning, or better yet, a pinguecula. The reasons for this are self-evident.

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## THE MAMMALIAN EYE, WITH SPECIAL REFERENCE TO THE FUNDUS APPEARANCES.

BY CASEY WOOD, M.D., D.C.L.

CHICAGO.

ALTHOUGH we have had isolated reports of the ophthalmoscopic findings in the eyes of a few domestic animals and of some others easily accessible to man, no comprehensive study of the ocular fundi of the lower animals was made until Geo. Lindsay Johnson, with the assistance of an unusually competent artist (Arthur W. Head), began his investigations over ten years ago. Their first contribution appeared in the *Proceedings of the Zoological Society of London* in January, 1897: "Observations on the Ophthalmoscopic Appearances of the Eyes of the Order Primates," illustrated by four colored plates. In May, 1900, Dr. Johnson communicated to the London Royal Society, "Contributions to the Comparative Anatomy of the Mammalian Eye, Chiefly Based on Ophthalmoscopic Examination." This essay was published in the *Philosophical Transactions*, 194, 1901, pp. 1-82, and reprinted in the form of a descriptive atlas containing about fifty large colored engravings of various animal fundi from original paintings by Arthur W. Head. This work gave merely the conclusions of the writer, it being his purpose to publish in due time a still larger volume in which the ocular backgrounds of many additional mammals are to

be pictured, together with those of representative amphibia and reptiles—the whole to be accompanied by a more complete treatise on the visual apparatus of these zoological subkingdoms.

Shortly after the appearance of Dr. Johnson's larger work I had the pleasure of presenting to the New Orleans meeting of the Ophthalmic Section, in a very incomplete fashion and poorly illustrated with ordinary black and white stereopticon slides, a few of the conclusions reached by the author. I refrained from printing these desultory remarks, partly because of their fragmentary character and partly because I understood that Dr. Johnson was then about to publish his larger atlas in which every zoologist and ophthalmologist might read a full account of this truly marvelous undertaking. Since this volume has, so far, not appeared and as Dr. Johnson's studies have excited comparatively little comment in ophthalmic circles, I again take the liberty, with the permission of the author and the aid of Mr. Head's reproductions in color of his original drawings, to give you some idea of the remarkable work that has been carried on by these two men. Another reason for this demonstration is that the monograph and atlas just referred to is out of print and practically unobtainable.

At the outset let us refresh our memories by looking at the following (Gadow's) classification of the mammals. Observations of the fundus oculi were made by Johnson in 182 species of Mammalia, comprising nine out of eleven Natural Orders, 103 Genera and 47 Families—the Whale and Sirenia being omitted. All the backgrounds were carefully painted, *ad naturam*, by Mr. Head. In these tables, taken from Dr. Johnson's treatise, I have, as far as possible, and for the sake of simplicity, indicated the species by their vulgar instead of their zoological names. In the list you will find italicized the names of those animals whose fundus pictures I hope to show you on the screen.

Natural Orders.	Families.	Genera.	Species and Varieties.
Primates.	Simiæ.	Anthropoidæ.	<i>Man.</i> <i>Chimpanzee.</i> Gorilla. <i>White-Handed Gibbon.</i> Orang.
		Cercopithecidae.	Pigtailed Macaque. Japanese Ape. Bonnet Monkey. Chacma Baboon. <i>Mandrill.</i> Yellow Baboon. Syke's Monkey. <i>Green Monkey.</i> <i>Black Ape.</i> <i>White Collared Mangabey.</i> <i>Sooty Mangabey.</i> <i>Diana Monkey.</i>
	Lemures.	Hapalidae.	The Marmosets. Squirrel Monkey.
		Cebidae.	Red Howler. Lagothrix. Nyctipithecus. <i>Lemurine Douroucouli.</i> Spider Monkey.
		Chiromyidae.	Aye-Aye.
		Lemurides.	<i>Crowned Lemur.</i> Brown Macaque. Black and Variegated Lemur.
	Galagoidæ.		<i>Lemur Coquereli.</i> Nycticebus Tardigradus. Loris. Galago garnetti. Maholi. <i>Galago Monterii.</i>
			English Bat. Indian Fruit Bat. <i>Australian Fruit Bat.</i>
			<i>Hedgehog.</i> Common Mole.
Chiroptera.			
Insectivora.			

Natural Orders.	Families.	Genera.	Species and Varieties.
Carnivora.	Pinnipedia.		Sea Lion. British Seal.
	Fissipedia.	Felidae.	Common Cat (many varieties). <i>Serval</i> . Tiger Cat. Siamese Cat. Cheetah. Puma. African Lion. Kaffir Cat. Ocelot.
		Viverridae.	Mongoose. Spotted Ichneumon. Genetta. <i>Levaillant's Cynictis</i> .
		Mustelidae.	<i>Canadian Skunk</i> . European Polecat. Cape Zorilla. Otter. Tayra. Sand Badger. Cape Badger. Pine Marten.
		Hyenidae.	Spotted Hyena. Brown Hyena. <i>Striped Hyena</i> .
		Canidae.	Domestic Dog of many varieties. Indian Wolf. Prairie Wolf. <i>Black-backed Jackal</i> . Common Jackal. Common Fox. Azara's Fox. Fennec Fox. Arctic Fox. Cape Hunting Dog. Australian Dingo.
		Procyonidae.	<i>American Racoon</i> . Bassaricyon. Kinkajou. Ringtailed Coati.
		Ursidae.	Syrian, Brown, Malay and Sloth Bears. <i>Black Bear</i> .

Natural Orders.	Families.	Genera.	Species and Varieties.
Ungulata.	Artiodactyla.	Selenodonta. (Ruminantia).	<i>Indian Ox.</i> Many varieties of the Common Ox, Sheep, Goat and Deer. Reindeer. Gazelle, <i>Bactrian Camel.</i> Llama. Chevrotain. Wild and Domestic Boar. Hippopotamus. Horse (many varieties). <i>Zebra.</i> Wild Ass. <i>American Tapir.</i> <i>Indian Rhinoceros.</i> Indian Elephant. <i>African Elephant.</i> <i>Dorsal Hyrax.</i> Porpoise.
Sirenia.			
Rodentia.	Myomorpha.	Dipodidae. Geomyiidae. Muridae.	Jerboa, Egyptian and Indian. Cape and American Pouched Rat. <i>Black Rat.</i> Common Rat (varieties). Mouse (varieties). Oak Dormouse. Garden Dormouse. Common Squirrel (varieties). Marmot. Ground Squirrel. <i>Red and White Flying Squirrel.</i> Indian Palm Squirrel. <i>Canadian Beaver.</i>
	Sciuromorpha.	Myoxidae. Sciuridae.	
		Pteromyidae. Castoridae.	

Natural Orders.	Families.	Genera.	Species and Varieties.
Edentata.	Hystricomorpha.	Chinchillidae.	Chinchilla. Viscacha.
		Cavidae.	<i>Guinea Pig</i> . Capybara. Spotted Cavy.
		Octodontidae.	Myopatus Coypa.
		Dasyproctidae.	Golden Agouti. Azara's Agouti.
		Hystricidae.	<i>Brazilian Porcupine</i> . Hairy Porcupine.
	Lagomorpha.	Leporidae.	<i>Common Rabbit</i> (varieties). Hare.
		Dasyopodidae.	<i>Hairy Armadillo</i> .
		Myrmecophagidae.	Great Anteater.
		Bradypodidae.	Three-toed Sloth.
		Phascologyidae.	Wombat.
Marsupialia.	Diprotodontia.	Macropodidae.	Tree Kangaroo. Black-faced Kangaroo. Red Kangaroo. Wallaby. <i>Rat Kangaroo</i> .
		Phalangistidae.	Black Phalanger. Squirrel Phalanger. Flying Phalanger.
		Didelphidae.	<i>Virginian Opossum</i> .
Monotremata.	Polyprotodontia.	Dasyuridae.	Tasmanian Devil.
		Peramelidae.	Bandicoot. <i>Rabbit-eared Perameles</i> .
		Echmida.	Two varieties of <i>Echmida</i> .



It may not be out of place here to refer to the methods employed by Johnson and Head in the examination and painting of the fundi of the lower animals. When one knows that this comparatively small section of the work was done on the living eyes of such animals as the lion, tiger, rhinoceros, bear, ourang, camel, tiger cat, zebra, wild ass, kangaroo, polecat, etc., one cannot but admire the bravery, patience and devotion to science for its own sake that have characterized their unique investigations. For example, as I listened to Mr. Head's account of his adventures while examining the ocular fundi of the largest *cobra di capello*, python and crocodile in the London "Zoo," it was borne in upon me that no soldier on the battlefield of science had exposed himself to greater dangers. I would advise those of you who are interested in this particular part of the investigation to read *Pearson's Magazine* for 1903, in which are reported at length some of Mr. Head's experiences while painting these wild animal fundi.

The erect image is the one portrayed in each instance, and the ordinary ophthalmoscope with a kerosene light or a common electric lamp was employed. I had the satisfaction some time ago of sending the investigators an American model of the self-illuminating electric ophthalmoscope, with which, as was self-evident, more effective work can be done in certain cases.

Both eyes were examined, the eyelids being held apart with the fingers or spring specula. In most cases mydriatics — homatropine, scopolamin or cocaine — were employed. General anæsthetics were given at first, but these were found undesirable. Some animals were muzzled or covered with a net, but, as a rule, coaxing, kindness and taming proved more effective. Wherever it was possible, several of the same species were examined so that errors due to diseases or to individual variations might be eliminated. The refraction was determined by skiascopy, and in most cases with and without atropine. The angle of optic divergence was measured by a specially devised goniometer.

Probably the most striking feature of the ocular fundi is the variety and intensity of the coloration. Ophthalmoscopists very justly claim that the background of the human

eye forms a most beautiful colored picture, but it is faded and colorless when compared with that of many an animal lower down in the zoological scale. Indeed, one of my purposes in presenting these pictures to-day, is to introduce a method of reproducing by means of stereopticon slides the brilliant coloring of the animal fundus recently invented by Mr. Head. Recognizing the failure of the ordinary colored slide to accomplish this result, he set to work some time ago to devise a means by which the wonderful coloration of these eyes could be adequately projected upon the screen. The pictures to be shown you to-day are the first slides of this kind that Mr. Head has prepared. I may also say that while the majority of the pictures appear in Johnson's Atlas, quite a few were prepared from drawings that are not reproduced there.

Dr. Johnson has divided the Mammalian fundi, so far as their color is concerned, into three categories: First, the RED TYPE, including every shade of red, brown, chocolate and gray. To this class, for example, Man and all the Primates belong. The YELLOW TYPE includes all shades of yellow and orange. Good examples of this class are found in those animals who have nocturnal habits. The GREEN AND YELLOW-GREEN TYPE comprise, among others, most of the Carnivora and many of the Ruminants. The color of the fundus in many animals is determined or modified by the thickened choroidal, or at least subretinal, layers known as the *tapetum lucidum*, *cellulosum* (in the Carnivora) or *fibrosum* (Ungulata). As is well known, in the nocturnal carnivora it glows and reflects a yellow-green light from its highly pigmented surface.

As will be noticed, many of the normal conditions observed in some of the lower animals resemble those one finds in man as pathological states, as congenital defects or as evolutionary remains. It will be sufficient now to mention the *membrana nictitans*, the retractor muscle of the globe, opaque nerve fibres, white or gray optic nerve-heads, pectinal remains, persistent hyaloid artery, optic coloboma, *retinitis pigmentosa* and visible choroidal vessels.

REFRACTION. The *wild* Mammals are simply hypermetropic; when domesticated for a number of generations they

generally become myopic and astigmatic. Fresh water amphibious Mammals have enormously developed ciliary muscles that enable them to compensate for loss of the refractive power of the cornea when the eye is submerged. The Common Seal and the Sea Lion both have a myopic refraction of 4 D. in the vertical meridian and 13 D. in the horizontal meridian. Their pupils are capable of contraction to a narrow vertical slit, so that they obtain fairly good vision both in air and water. Matthiesen, who examined a number of Whales common to the Arctic coast of Norway, found their eyes astigmatic four or five diopters.

The appearances of the fundus oculi have a decided bearing on *classification*, as will be readily seen even in this imperfect demonstration of Johnson's work. Although, as he points out, a sound classification cannot and ought not to be based upon the peculiarities of a single organ, yet the fundus appearances are so definite and so constant in all the wild species that these can be readily grouped into genera, families and natural orders according to their ophthalmoscopic pictures, a fact that must surely appeal to every zoologist. As it happens, these fundus pictures correspond very closely to the generally received classification, although there are a few disagreements, one or two of which I hope to indicate.

Although Man and the other Simiae alone possess a distinct and well defined *fovea centralis* or macular region, many other animals, the Ruminants and Carnivora for example, have a *sensitive visual area*, devoid of blood vessels, that probably acts as an extensive, although not particularly specialized macula. On the other hand, there is nothing about the background of many animals to indicate that one locality of the retina is more sensitive to light and form than any other.

*The divergence of the optic axes.* Johnson measured this by a special goniometer in many instances. The diagram shows that it is only the Simiae—in other words man and the true monkeys—that possess the power of convergence, and that only they have parallel vision when the eyes are in a state of rest. Parallel vision is associated, as will soon be noticed in the pictures I am about to show you, with a circular disc, well defined retinal vessels and, above all, with a well defined macula. I daresay the association might

be carried further by including binocular vision and extensive crossing of the optic fibres at a well developed chiasma.

#### MAN.

*Primates, Simiae, Anthropoidae, Man.* The first variety of this species is represented in our pictures by the left fundus of a Nubian, aged 17. You will, I think, recognize a striking resemblance between it and that of the anthropoid apes. The background is chocolate colored and the retinal reflexes are very marked, extending over the whole macular region. Translucent nerve fibres can be traced much beyond the papilla. The macula is well defined and surrounded by a brilliant reflex-ring. The choroidal vessels, in contrast to those of the average European eye, are quite invisible.

In striking contrast with this picture is the fundus of a human *albino*, well known to all of you. I call especial attention to the differences in these fundi because each detail has its analogue in the lower animal backgrounds I am about to show you. As in fair-haired Europeans, the general color of the fundus is a light orange red; there is a complete absence of the peculiar glistening sheen observed in the neighborhood of the vessels and macula of the negro, and no traces of opaque nerve fibres can be discovered. The choroidal vessels are readily seen through the imperfectly pigmented background; in some albinos they are visible near the macula.

#### ANTHROPOID APES.

*Chimpanzee (Troglodes niger).* The resemblance between the ocular fundus of this animal and that of the African youth just exhibited is very striking. Except that the differences between the veins and arteries are less marked and that their branches are straighter in the anthropoid ape, they are practically the same picture.

*White-handed Gibbon (Hylobates albimanus).* Here the nerve fibre layer and reflexes are prominent, the macular area is small, while, most noticeable of all, well marked choroidal vessels radiate from the disc to the periphery of the background.

With the exception of the color of the fundus, the ophthalmoscopic characters of man are common to all the higher monkeys.

## DOG-FACED BABOONS.

*Primates, Simiae, Cercopithecidae.* The Dog-faced Baboons have a fundus more or less patterned after the Gibbon. The *Mandrill* (*Cynocephalus mormon*), however, exhibits the choroidal vessels more marked than in the Baboon. This ugly looking monkey possesses a power of sustained convergence equal to any of the man-like apes.

This picture does not appear in Johnson's Atlas, but is reproduced from an original drawing by Head, not yet published.

A common example of the medium sized Simian is that active and quarrelsome animal, the *Green Monkey* (*Ceropithecus callitrichus*). Its fundus resembles that of the *Mandrill*, but it has one peculiarity—a macular region twice the diameter of any other Old World monkey.

This painting does not appear in Johnson's Atlas.

Two *Mangabeys*, those lively, good natured and rather common monkeys, often encountered as pets, are represented in this demonstration, neither of the paintings being reproduced in Johnson's Atlas. The *White-collared Mangabey* (*Cerocebus collaris*) has a fundus like that of the *White-handed Gibbon*, except that the macular region is a dark brown spot with a well marked foveal reflex in the smaller monkey.

The *Sooty Mangabey* (*Cerocebus fuliginosus*) exhibits the same peculiarity, a better defined macula surrounded by a complete ring. The choroidal vessels are somewhat plainer than in the majority of the smaller monkeys.

The fundus of the *Black Ape* (*Cynopithecus niger*), an African monkey belonging to the same genus as the *Mangabey*, exhibits a well marked macular ring, probably due to the dark color of the animal itself. The background is gray and the vessel-reflexes show very plainly. His convergence power is excellent.

This is also an unpublished original painting by Head.

The *Diana Monkey* (*Cercopithecus diana*) is a handsome and easily tamed animal, often kept as a pet. Owing to his dark fur and the amount of pigment in his body he has, like the *Black Ape*, a dark gray fundus and obscure choroidal vessels. Otherwise his fundus resembles that of the other

medium sized monkeys.

This picture does not appear in the Johnson Atlas.

*Primates, Simiae, Cebidae, Lemurine Douroucoli* (*Nyctipithecus lemurinus*). The fundus of this South American monkey shows a macula well defined, but the macular ring has disappeared. To a considerable extent it resembles the true Lemures, although its eyes show certain peculiarities. The whole background is covered with dots and resembles the lower lemures closely, except that the disc is pink, like that of man and the higher apes, and there is a well defined macula. The choroidal vessels are well shown, but not so well as in the White-handed Gibbon.

All the Simiae invariably have circular pupils that dilate to mydriates and contract to miotics; in that respect Man differs only in degree from the other Simians. They are also the only Mammals that have parallel visual axes and possess the power of convergence, the necessary accompaniment of a macula. It must be remembered that most monkeys are able to converge for a short period only. Johnson notices a peculiar fact, that while the refraction of the higher monkeys, like savage Man, is hyperopia without much astigmatism, the Mandrills and Drills are all myopic from 3 to 6 D. As in Man, the *membrana nictitans* is rudimentary. Man alone sheds tears; the lachrymal puncta and canaliculi are rudimentary in all other Simiae, although the caruncle is present.

#### THE LEMURES OR HALF-MONKEYS.

*Primates, Lemures, Lemuridae, Crowned Lemur* (*Lemur coronatus*). Here is a well marked fundus. As in all animals below the true monkeys (Simiae), there is in this background no macula. The disc is chalk colored, as if the animal were the subject of a white optic atrophy. The vessels, however, are well shown and their absence in a particular area probably indicates the location of the sensitive macula.

*Primates, Lemures, Galagoidae, Lemur coquereli*. Although all the classifications include this animal and the next one whose fundus I shall show you, among the true Lemurs it is evident that ophthalmoscopically there is little in common between them and the Lemuridae. Indeed it is more than likely that these Galagoidae are not Lemures at all, but are more closely allied to the night-prowling carnivora,

whose fundi, as we shall see, they closely resemble. As early as 1897 Lindsay Johnson drew the attention of zoologists to this fact in a paper before the London Zoological Society. He said: "When we come to the Lemures we do not find a single animal which possesses even a trace of a macula, and the discs are all round. Instead of being pink they are quite white and the fundus is of a peculiar brown or grayish brown color stippled at intervals with large dots. In the true Galagos the disc is nearly black; the fundus is a rich golden-yellow with a tinge of green and covered everywhere with minute black or brown stellate spots. The star-shaped dots are peculiar to the Galagos and we find them in all, just as we see a distinct family likeness in the Lemures. Among the latter, however, there is one exception, its fundus being identical with that of the Galagos and yet is known as Coquerel's Lemur. I have examined this animal most carefully and am convinced that it is a Galago and not a Lemur. The difference of its eye is too striking to be overlooked and quite outweighs the other differences of structure and habitat."

Looking once more at the canvas we see at once that the animal possesses a *tapetum lucidum et nigrum*, so well shown in the Felidae, and betraying his nocturnal habits. The fundus looks as if it were made of burnished gold strewn with stars. The disc is dark gray and the periphery is covered with a dense network of pigments.

*Galago Monterii*. It will be seen at once that the description just given of Coquerel's Lemur applies exactly to this fundus picture, and one can readily believe that they both belong the same genus. Johnson remarks that the division between the higher and lower orders of monkeys is chiefly marked by the absence of a macula in the latter. The pupil is no longer circular but oval vertically, while the visual axes are not parallel but slightly divergent and are incapable of even momentary convergence. Moreover, the disc is no longer pink but is covered more or less with black pigment. The Simiae alone among Mammals rotate their eyes in fixation; the lower families, instead, move their heads, and only on rare occasions and to a limited extent do they move their eyes for visual purposes.

## THE BATS.

*Chiroptera.* The fundus oculi of the *Australian Fruit Bat* (*Pteropus policephalus*) is like that of all bats. It exhibits a picture entirely unlike any that we have so far seen and certainly indicates a lower position in the animal world than zoologists have generally assigned to its owner. The ordinary bats have such minute eyes and pupils that it is extremely difficult to paint them.

The entire background of the Australian Bat is of a uniform pinkish color, covered uniformly with large, round dots which when seen with the ophthalmoscope might easily be mistaken for pits. The papilla is grayish-white and nearly round. There are no visible vessels except a single, minute capillary in the center of the disc. The picture is certainly that of a primitive type. Johnson says that this bat's large, round pupils act sluggishly to light and mydriatics and that continued exposure to bright light produces blindness.

## INSECT-EATING ANIMALS.

Speaking of the Insectivora in general Lindsay Johnson notes that the background is a uniform light gray, their eyes are equally round and small; the cornea is conical, the lids resemble a buttonhole and are destitute of lashes. The eyeball of the Mole can be projected forward several times its own diameter beyond the orbit and retracted in like manner. This is necessary for vision, as the animal's dense fur entirely covers the eye and it is needful that the eye be pushed forward between the hairs and so make a gap through which he can see.

*Insectivora, Common Hedgehog* (*Erinaceus europaeus*). Here we have a fundus of a somewhat higher type than that seen in the previous animal. The disc is small, pink and circular and exhibits two distinct sets of blood vessels. From the center there radiate to the periphery five vessels of unequal caliber, four of them giving off each a small branch on its way. From the edge of the disc spring a large number of capillaries which are soon lost to view. The veins cannot be distinguished from the arteries and there are no visible choroidal capillaries.



## THE SEALS.

*Carnivora, Pinnipedia, Common Seal* (*Phoca vitulina*). This fundus, like that of all the *Carnivora*, is brilliantly colored, in this instance bright yellow, sprinkled with green dots. The disc is pale, brownish red and bordered with green. Twelve vessels arise from the papillary border, curl over it and are distributed to the periphery of the field. The veins cannot be distinguished from the arteries. (Fig.1)

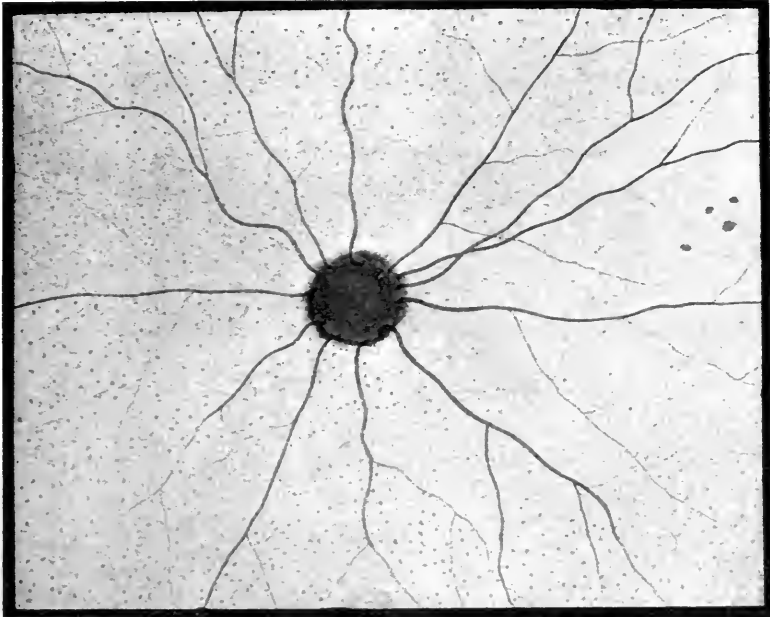


Fig. 1. Fundus of the Common Seal. [Lindsay Johnson Atlas.]

## BEASTS OF PREY.

*Carnivora, Fissipedia, Felidae*. The *Serval* or *Tiger Cat* (*Felis serval*). This fundus is a good example of that seen in all the cat tribe. Generally there are three distinct, colored zones, the central one occupying about one-third of the whole field. It is light-gold in color, extremely brilliant, and represents the area of best vision. It is also from this portion of the background that the prowling carnivore flashes into the darkness those rays of light that have so long distinguished his yellow-green eyes. This important zone is surrounded by an emerald-green layer of variable

width, while the most peripheral zone is of a dense purple-brown color, probably a part of the ora serrata and insensitive to light. In all the Carnivora the disc is round and cupped, in some instances reminding one of a glaucomatous excavation. The pupils are generally round, although there are many exceptions to this rule. However, the pupils of the cat family are round when fully dilated, contracting to a vertically oval slit or to a straight line in all the small animals, but in the larger animals—the tiger, lion, puma, etc.—they remain round as in man. The Felidae possess no power of convergence and do not move their eyeballs for visual purposes unless trained to do so. It must be remembered, in passing, that domestication and artificial selection *affect the color of the ocular fundus and the refraction of the animal* to a considerable degree. The refraction of domestic animals (cat, dog, horse) is not the same as that of the corresponding wild species—the tendency being always in the direction of myopia and astigmatism. All the Carnivora have a movable membrana nictitans, although few of them move it freely.

*Carnivora, Fissipedia, Viverridae, Levaillant's Cynictis* (Cynictis penicillata). The peculiarity of this carnivore—a curious little South African animal something like our Prairie Dog—is that it has no pigmented zones in its fundus, but presents a uniform dark gray or lead color. The vessels that radiate from the disc are readily distinguished as veins and arteries; the papilla is horizontally oval and covered with a network of dark pigment. From it regular, linear, opaque nerve fibres radiate almost to the periphery. Altogether, this animal, as well as his brethren, the Mongoose and Ichneumon, has an ocular background quite unlike the other Fissipedia.

#### THE MARTENS.

*Carnivora, Fissipedia, Mustelidae, Common Skunk* (Mephitis mephitis). All the Marten families (Mustelidae) have round discs; in some it is cup-shaped and the vessels, as in the Felidae, curl over it. The North American Skunk forms an exception to the usual rule of the Carnivora, in that the disc is white and cupped, with six vessels arising from its margin and opaque nerve fibres radiating from its substance.

The fundus is of a pale, canary-yellow color, changing to a mottled drab near the lower edge of the disc. The *tapetum lucidum* is not as well developed as in the other carnivores. In many respects his animal resembles the rodents; the eyes protrude, there is no *membrana nictitans* and the refraction is high hyperopia (5 D.).

#### THE HYENAS.

*Carnivora, Fissipedia, Hyenidae.* All the Hyenas resemble the Cats in retinal blood supply and in fundus coloration. There are three zones—the central, golden yellow; the intermediate, green; the peripheral, violet. In the background of the *Striped Hyena* (*Hyena striata*) the disc is brown and not cupped, and the whole field is covered with minute dots, as in the Felidae. The pupil of this species is vertically oval when the animal is at rest, but when disturbed it immediately contracts to a complete circle. This and the further fact of the brilliant central zone in the fundus go along with the nocturnal habits of the animal.

#### THE DOGS.

*Carnivora, Fissipedia, Canidae.* The beautiful fundi of all the Wild Dogs resemble those of the Cats and Hyenas in exhibiting three highly colored zones—an outside one reddish or violet-brown, an intermediate green area and a central zone (*tapetum ludicum*)—characteristic of higher animals—of a bright golden-yellow. The papilla is not excavated and varies in shape and size. The vessel distribution also varies; as a rule both veins and arteries tend upwards before they spread out over the fundus. All the Wolves have round pupils; all the Foxes have oval pupils. From this circumstance alone, Johnson believes that our domestic Dog is derived from the Wolf and Jackal, and not, as some have asserted, from the Foxes. The wild Canidae are hyperopic or emmetropic and free of marked astigmatism, while the domestic Dog often exhibits myopic or compound myopic astigmatism.

In the fundus oculi of the *Common Jackal* (*Canis aureus*) the central *tapetum lucidum* is of a golden color and very large. The intermediate green area is correspondingly small and bordered externally by a narrow violet zone which runs

into the deep purple peripheral zone. The disc is bright pink and lozenge shaped—a form peculiar to the Foxes and Jackals. The central vessels are numerous and stretch well to the periphery.

*Carnivora, Fissipedia, Procyonidae.* The fundus of the *American Racoon* (*Procyon lotor*) has points of resemblance to both the Polecats and Bears. In all three genera we notice the fundus pigment arranged in a crystalline fashion. The pale, golden-yellow zone has a number of rice shaped, yellowish dots scattered over it. The peripheral zone is partly brown in color.

#### THE BEARS.

*Carnivora, Fissipedia, Ursidae.* Nearly all the Bears have round pupils. In the *American Black Bear* (*Ursus americanus*) they are vertically oval; round, when fully dilated. They all have *membranae nictitantes*, which show only when the animal is sleepy. The ocular fundus is about the same in each species and closely resembles that of the Racoon. In our Black Bear the yellow zone is absent, but orange pigment is distributed between it and the peripheral zone. The latter is deep brown, as in the Racoon. The disc is round and cupped; the fundus pigment has a patchy, crystalline appearance, like coarse sugar scattered over the background.

#### HOOFED ANIMALS.

The eyes of the important family of the *Ungulata*, Johnson finds to be divisible, so far as the fundus appearances go, into two great classes. The cloven hoofed (*Artiodactyla*)—ox, sheep, deer, camel, pig, etc.—have numerous large retinal capillaries; while others—horse, rhinoceros, elephant, zebra, etc.—have either very fine papillary vessels or present discs entirely devoid of visible blood supply. The Elephant, Tapir and Rhinoceros have circular pupils; in all the other Ungulates they are horizontally oval. The pupils are insensitive to mydriatics but contract well to light. (Fig. 2).

The irides, as a rule, are composed of two distinct layers, the inner stratum being capable of projection into the pupillary space, in much the same manner as an awning is let down in front of a shop window and for the same purpose.

This *corpus nigrum*, or shield to the sensitive retina from the glare of the sun, is fairly well seen in the domestic Horse and Goat. The best examples occur in the Hyrax, the Camel and the Llama, where it is developed into a special organ, and to it Johnson gives a particular name—*umbraculum*. In the Horse we see it as a simple hypertrophy of the lower pigment layer of the iris. It is somewhat thicker and larger in the Wild Ass, modulated in the Gazelle and Goat, and further elaborated in the Camel and Llama, forming in the

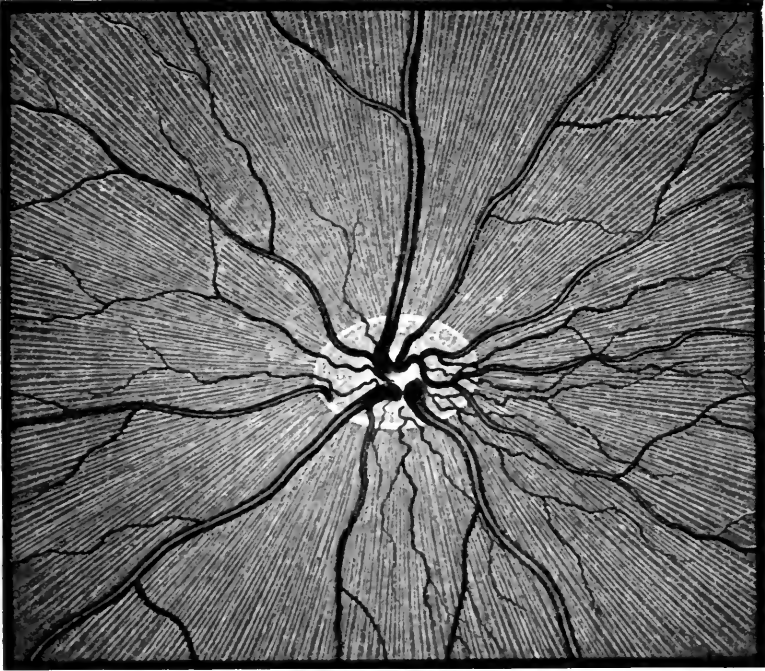


Fig. 2. Fundus of the Wild Boar. [Lindsay Johnson Atlas.]

latter a series of dentate projections that fit into one another when the pupil is fully contracted. In the Cape Hyrax or Klip-dass (an interesting animal that resembles in habits and appearance a Guinea Pig) we have the most highly developed of these appendages. Johnson believes it to be under the control of the will, as its movements are independent of the amount of light.

The refraction of the Ungulata is invariably a compound hypermetropic astigmatism. They have nearly all more or less well developed *tapeta lucida*.

## THE RUMINANTS.

*Ungulata, Artiodactyla; Ruminantia.* The fundus of the *Indian Ox* (*Bos indicus*) is like that of our domestic cow, and indeed resembles those of all the other Ruminants. The disc is horizontally oval and very large, with a central circular depression. The main artery and vein, of large size, spring from the sides of this cup and ascend, giving off, at right angles, branches to the central light colored area. Downwards to the dark peripheral zone run numerous and more tortuous vessels, while the intermediate rose-colored band seems free of vascular supply. Lindsay Johnson believes this middle zone to be the seat of acute vision.

*Bactrian Camel* (*Camelus bactrianus*). This is another remarkable fundus picture, evidently only a variant of the previous one. It is of a uniform chocolate-red (there being no *tapetum lucidum*), the larger part light in color because of the innumerable opaque nerve fibres. The disc is circular, white, and covered with a pigment network. The intertwined artery and vein ascend from the optic papilla, giving off both horizontal and oblique branches.

*Ungulata, Perissodactyla, Equidae.* The fundus of the Horse, Zebra, Wild Ass, American Tapir, Indian Rhinoceros, African Elephant and Dorsal Hyrax—all belonging to the genus *Perissodactyla*—are devoid of retinal vessels. The eyes of the first three may be described as one—that of the Zebra—so closely related is their whole ocular apparatus. The fundus of the *Zebra* (*Zebra burchelli*) is divided into two zones, a peripheral violet-brown zone, deeply pigmented and a central zone, lying immediately above the disc, stippled with purple-brown, star-shaped spots on a colored ground. In the Horse and Zebra the background is yellow-green; in the Wild Ass it is a mixture of yellow and bluish green. The disc is pink and oval; numerous minute capillaries are seen at the disc edge, but these can be traced for a short distance only. Opaque nerve fibres are also present. As frequently observed, domestication affects the coloration of the background; various horses have varied fundus coloring. All the *Equidae* have a well developed nictitating membrane which they use freely. The pigmented protrusion at the edge of the iris, or *corpus nigrum*, is more highly developed in the wild than in the tame animal.

*Ungulata, Perissodactyla, Tapiridae.* The *Brazilian Tapir* (*Tapirus americanus*) being a night animal, has a bright, golden-yellow fundus which is stippled with orange dots. The peripheral zone is orange-red. There are only a few minute retinal vessels, restricted to the edge of a chalky-white disc.

*Ungulata, Perissodactyla, Rhinocerotidae.* Every Rhinoceros has small, bright, twinkling eyes, the twinkling being due to a rapid, oblique movement of the globe outward and slightly upward, motions performed by the animal every few seconds. In this way the Rhinoceros is enabled to look around without the necessity of turning his massive and unwieldy head. The pupil, 9 mm. in diameter, is surrounded by a dark iris. There is well formed membrana nictitans. The fundus oculi of the *Indian Rhinoceros* (*Rhinoceros unicornus*)—an animal specially protected by dermal armor—is certainly primitive. There is little to be seen except a large, white, round disc in the center of a violet-brown field which is covered with a faint network of pigment.

*Ungulata, Proboscidae, Elephantidae.* The *Elephant*, both Indian and African, has a yellow-ochre fundus with bacillus-like markings which are more prominent in the older animals. The disc is round and grayish-white. A few small capillaries run from the central cup to the margin of the discs. The pupil of the Elephant is circular and he has a well marked membrana nictitans but makes little use of it.

*Ungulata, Hyracoidae.* The most peculiar part of the ocular apparatus of *Hyrax* (*Hyrax dorsalis*) is his well developed *corpus nigrum*. As we already know, it is a highly contractile, awning-like appendage formed by an extension of the upper margin of the iris. Upon exposure of the eyes to bright sunlight it projects downward and forward to the posterior surface of the cornea. The fundus pictures of all the Hyracoidae are almost indetical and somewhat resemble the Elephant. The faintly stippled, reddish-brown background shows a few traces of choroidal vessels. The disc is pinkish and has a few oddly disposed vessels running from its center. Opaque nerve fibres, symmetrically disposed, radiate several diameters from the papillary border.

## THE RODENTS.

The Rodentia have all circular or nearly circular pupils under all conditions of expansion or contraction. The wild animals invariably exhibit hyperopia which tends toward myopia and astigmatism in captivity. Thus domestic Rabbits show all degrees of refraction with astigmatism, while the common wild Hare is markedly hypermetropic. All rodents have the power of retracting the eye into the orbit, the lid closing as the organ is withdrawn into its socket. The nictitating membrane is rudimentary and the cornea is nearly a perfect hemisphere. The crystalline lens in the majority seems to be formed of concentric circles, which make it difficult to examine the fundus details.

*Rodentia, Myomorpha, Muridae.* The fundus of the *Black Rat* (*Mus rattus*) is uniformly gray in color. The *White Rat*, by the way, has the usual bleached background of the albino. No trace of choroidal vessels can be seen. The disc is reduced to a mere point, obscured by the large central vessels, which radiate from the center like the arms of a starfish. Johnson has examined anatomically the optic nerve of these animals and says it is no larger than a cotton thread. Faint opaque nerve fibres are also to be seen in this fundus.

*Rodentia, Sciuromorpha, Sciuridae.* The *Squirrel* has a more varied and more curious ocular fundus than that found in any other genus. This fact inclines Johnson to the belief that in it have been included members that properly belong to other zoological households. The *Common Squirrel* (*Sciurus vulgaris*) shows a wonderfully large nerve-head for such a small eye. It is much elongated, irregularly bow-shaped and placed well above the axis of vision. The whole area of this papilla measures four times that of the Elephant. The ends are distinctly clubbed. The retinal vessels are large as well as numerous, and spring from the margins of the disc in parallel lines. The disc is whitish and depressed below the fundus so that the vessels curl over its edge. Innumerable minute nerve fibres, arranged like the teeth of a fine comb, run from the disc edge. As Johnson says, the whole arrangements reminds one of a centipede. The fundus coloring is pale pink, the retinal arteries cannot be distinguished from



veins, and towards the periphery the choroidal vessels are visible.

*Rodentia, Sciuromorpha, Castoridae.* The Beavers have an ocular fundus all their own. In the *Canadian Beaver* (*Castor canadensis*) the disc is circular and white, with a deeply pigmented elevation at its center. About this organ (probably a hyaloid remnant which projects several millimetres into the vitreous) a few minute capillaries may be seen. Otherwise there are no visible retinal vessels. The fundus is pale brown and covered with a network of choroidal capillaries. There are no opaque nerve fibres. It may be added that the Chinchilla has an almost identical fundus, except that there is no central projection from the disc.

*Rodentia, Hystricomorpha, Cavidae.* The fundus of the Hystricomorpha—chinchilla, guinea pig, agouti, porcupine, etc.—exhibits no retinal vessels, but generally a number of fine capillaries can be seen on the edge of the disc. In most of these animals a pecten-like protuberance, consisting of pigment cells and blood vessels can be seen extending from the center of the disc into the vitreous. The *Guinea Pig* (*Cavia porcellus*) has a fundus something like that of the Beaver except that there is a well marked “sunburst” of opaque nerve fibres with the papilla for its center. As has been noticed, variations occur—even in this primitive eye—under the influence of domestication.

*Rodentia, Hystricomorpha, Cavidae.* The Porcupines—as in the case of the Rhinoceros, Armadillo and other animals especially protected by nature from external injury—have exceedingly primitive eyes. The *Brazilian Porcupine* (*Sphingurus prehensilis*) has a vermillion fundus with orange streaks, probably corresponding to large, concealed choroidal vessels. No retinal vessels can be seen. There is no distinct peripheral area, while the round disc is bluish-gray and devoid of visible blood supply.

*Rodentia, Logomorpha, Leporidae.* The *Domestic Rabbit* (*Lepus cuniculus*) has a vermillion-red fundus; the wild Hare a lake-colored background; otherwise these remarkable pictures are identical. An ovoid white disc is seen, well above the visual axis, from which retinal vessels branch right and left in a horizontal plane. The area they

occupy is covered by a large dense "brush" of completely opaque nerve fibres, arranged like two white horse-tails, or like two ostrich feathers joined at their quills. As the vessels and opaque fibres are confined to one portion of the fundus, vision is not interfered with except in this locality. (Fig. 3).

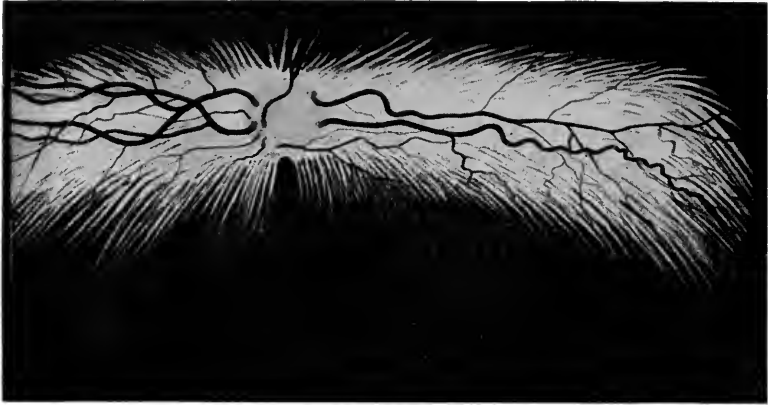


Fig. 3. Fundus of the Common Rabbit. [Lindsay Johnson Atlas.]

#### EDENTATA.

The eyes of this family are very sensitive to light, and consequently difficult to examine with the ophthalmoscope. The pupil is very small but dilates easily under atropia. As in the Bears, they possess the power of retracting the globe well within the orbit. The fundus is that of a rudimentary visual organ. The background is slightly stippled but is otherwise of a uniform color.

*Edentata, Dasypodidae.* The *Hairy Armadillo* (*Dasypus villosus*) exhibits a typical edentate fundus. It is of a uniform reddish-brown with a large, round, chalk-white disc showing no trace of blood vessels. The papilla is situated above the visual axis; altogether a primitive eye, such as one would expect to find in an animal depending upon armor, or at least not dependent upon his eyesight for food or protection. He has well formed eyelids and winks every few seconds, the eyeball receding each time, while the lids bend inwards toward the apex of the orbit instead of sliding over the globe as they do in man. There is no *membrana nictitans*.

## MARSUPIALIA.

In conclusion, we reach the Marsupials. This family—the “odds and ends” of the Mammals—has almost every one primitive eyes. Many exhibit the pecten, as a reminder of their reptilian (or rather sauropsidian) ancestry, and few of them have retinal vessels. All possess circular pupils and an active *membrana nictitans*.

*Marsupialia*, *Diprotodontia*, *Marsupodae*. The *Kangaroo Rat* (*Hypsiprymnus rufescens*) has a brownish fundus, with few retinal vessels, but numerous prominent choroidal vessels. The latter are large and of uniform size.

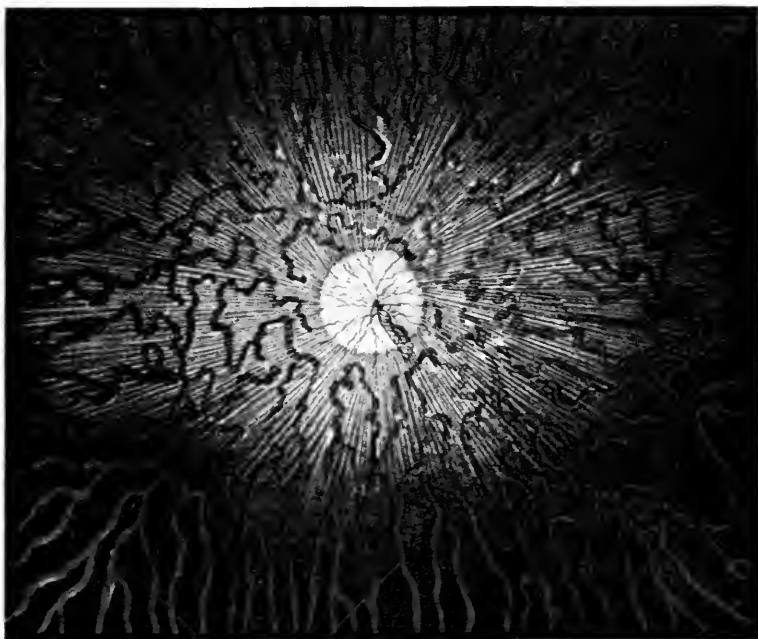


Fig. 4. Fundus of the Rat Kangaroo. [Lindsay Johnson Atlas.]

They ramify throughout the background of the eye and anastomose around the papilla. The disc is yellow white, covered with minute capillaries and presents a sausage-like projection from its center into the vitreous. The latter formation is mostly made up of festoons of vessels derived from the central artery of the retina. (Fig. 4).

*Marsupialia*, *Polyprotodontia*, *Didelphidae*. Our own particular Marsupial, the *Virginia Opossum* (*Didelphys virginiana*), differs ophthalmoscopically from other members of his family. The Tasmanian Devil and he are the only members of it with retinal vessels. As he is a nocturnal animal also, he has a well developed tapetum lucidum. The Opossum has another peculiarity: although devoid of a true nictitating membrane, two folds of conjunctival tissue arise from either canthus, meet in the meridian line, cover up the eye entirely in a sort of loose double bag and when function-

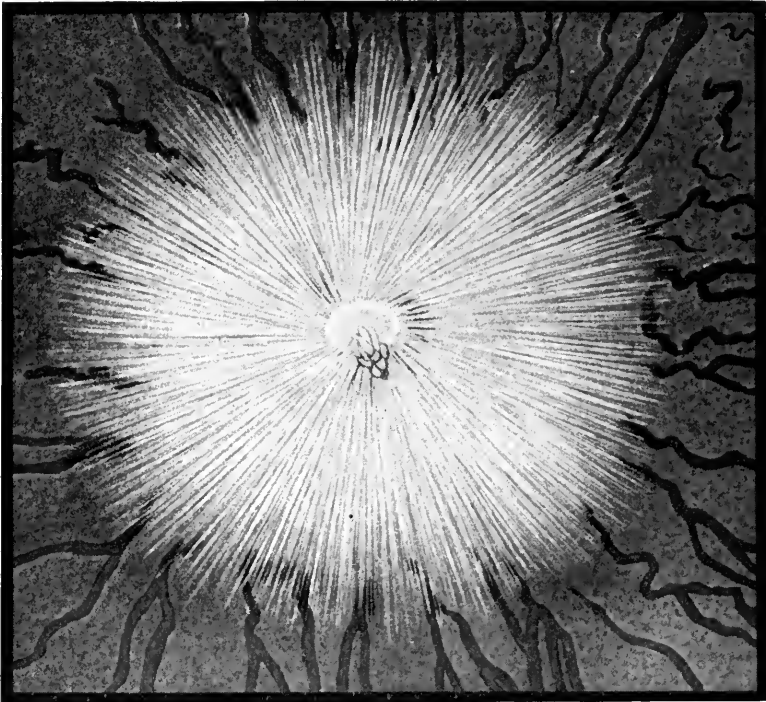


Fig. 5. Fundus of the Rabbit-eared Perameles. [Lindsay Johnson Atlas].

ating force the eye back into the orbit. When this organ is in use the animal looks as if he had projecting from his cornea a large edematous tumor. The central zone of the ocular background is of a brilliant golden-yellow, surrounded by a peripheral zone of grayish-black, with interspaces through which the golden-yellow color shines. It has a gray disc, with well developed and equally radiant vessels.

*Marsupialia*, *Polyprotontia*, *Peramelidae*. The Bandicoots, have remarkable backgrounds. The *Rabbit-eared Perameles* (*Perameles lagotis*), another curious Marsupial, exhibits a wonderful arrangement of concentric opaque nerve fibres about the disc, extending to the periphery and making a figure like a white China aster. A pectinate remnant covered with minute vessels and fashioned like a miniature wicker basket occupies the center of a gray-white ovoid papilla. Unusually large choroidal vessels ramify throughout the fundus. (Fig. 5).

*Monotremata*. The *Echidna* or *Spiny Ant-eater* (*Tachyglossus aculeatus*) of New South Wales has a circular pupil, no *membrana nictitans*, and a fundus of the most primitive type, all corresponding to his doubtful position in the Mammalian world. Like other Marsupials, he is able to retract his eyeballs. The background is of a lavender color throughout, the papilla being large, chalk-white and vertically oval. Neither retinal nor choroidal vessels are to be seen. Faintly outlined, short-ray, nerve fibres surround the optic disc.

#### CONCLUSIONS.

From a study of the eyes of the Mammals and particularly from the observations made by Lindsay Johnson on the appearances of the ocular fundi, I believe we are justified in drawing the following conclusions:

First—The fundus appearances of the normal Mammalian eye are practically identical in wild individuals of the same species.

Second—Common features in the ophthalmoscopic picture are strikingly apparent in the members of the same genus, and even of the same family.

Third—As a consequence of the foregoing, the importance of using the ophthalmoscope in the classification of animals possessing eyes whose fundi can be seen is of great importance.

Fourth—A complete account of any animal in a systematic treatise on zoology should include, when it is possible, at least a brief description of the ocular fundus. In other words, the practical zoologist should be able to use the ophthalmoscope.

Fifth—Apart from disease, the principal cause of the variations in the color and other details of the fundus oculi of species is domestication.

Sixth—Doubtless the habits and environment of the animal have been the chief factors in determining the coloration and other features of his eyegrounds.

Seventh—Ophthalmoscopic studies of the eyes of the lower animals throw considerable light on the anatomy, physiology and embryology of the human eye.

Eighth—An examination of the eye-interiors of representative species proves that some of the conditions observable in certain animals have their analogues in man as acquired disease, as congenital defects, and as ancestral remains.

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## THE CILIARY PROCESSES IN ACCOMMODATION.

By F. PARK LEWIS, M.D.

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THE object of this paper is three fold:

1st—To urge the importance of the ciliary region as the physiologic center of the eye.

2nd—To point out that the most commonly accepted theory of accommodation lacks one essential element to make it operative.

3rd—To show that the acceptance of this view makes the ciliary region the pathologic center also.

In practically every case that comes under the observation of the ophthalmologist except such as are obviously traumatic or due to some constitutional lesion, and even occasionally in these, that part of the eye of primary importance in its bearing on the conditions present is the mechanism upon which accommodation depends.

Being the intermediary apparatus between the cornea and the retina and having attachments to the choroid, there is actually no intra-ocular disease which may not be modified by the condition of this pivotal structure on which the act of vision turns. It is possible that a better understanding of the relationships of the tissues entering into the mechanism of accommodation in the human eye, may throw the needed

light on the causes of the obstruction of the filtration angle in that obscure problem chronic glaucoma, notwithstanding the experiments of Hess and Heine tending to show that accommodation does not increase the intra-ocular pressure. A fuller knowledge as to the properties and functions of the congeries of bloodvessels constituting the ciliary processes will make clearer the nature of the retrogressive nutritive changes which result, often prematurely, in cataract. The irritation produced by strained focal efforts is often the dominant cause of retrogressive corneal changes, and the relief which follows the use of atropine is due to the quieted ciliary body rather than to any effect of the drug on the cornea itself. It follows, therefore, that as almost all abnormal eye conditions are attached to, if not contingent upon refractive aberrations, it is of first importance that the anatomic and physiologic relations of this region should be clearly understood. It seems curious that with all the careful studies that have been carried on during recent years concerning the finer workings of human structures, one function that as yet has, at least measurably, eluded us, is performed in perfectly plain view, and is under our combined critical observation thousands of times every day. Whenever we look into the human eye accommodative changes are taking place, but so quickly and smoothly do the movements occur that they are absolutely invisible to us. It is only when they are interrupted—when some obstruction gets into the evenly working cogs and the natural processes are retarded—that we can in some measure see what had been taking place. It is, to change the figure, as though a stream were flowing so swiftly as to appear to stand absolutely still and it is not until the flow is impeded that we are able to realize the nature of the current and the rapidity and direction of its motion. Hence it is that, important as are the studies of the physicist and physiologist concerning this function of the human eye, it is to the clinician and the pathologist that we must come for the final word on the subject.

The test of a theory is that it perfectly explains the action of the organ to which it applies; and it must fall in line with each clinical condition as it arises. None of the theories which have so far been formulated in regard to accommodation

meet those requirements, and I wish to suggest one which seems to do so.

Briefly, there are three possible methods by which accommodation could be effected, excluding, as disproven, any alteration in the curvature of the cornea, or of the fundus, or any backward and forward movement of the entire lens. These are: First, the method of Helmholtz based upon an inherent elasticity within the lens capsule with a relaxed zonule and requiring for a shortened focus an increase in curvature of the entire anterior lenticular surface. Second, the method of Tscherning founded on the assumption of the formation of a lenticonus in accommodation, with a tense zonule; and, Third, the method of Dudgeon which seems to have been overlooked by most observers, as I can find no reference to it, and which assumes an inelastic lens and requires as an explanation of its focal adjustment an axial rotation which as the lens is paraboloid in form and not bi-convex, would give in effect precisely the lenticonus that Tscherning thinks that he has demonstrated.

Assuming then that Tscherning's observations which have been so carefully made and so accurately described are correct, and omitting any discussion at this time as to the possibility of an axial rotation as suggested by Dudgeon, the inquiry naturally arises whether the mechanical changes which occur in accommodation are inadequately explained by the employment of the ciliary muscle alone. It does not seem to me that they are. It would be impossible with a relaxed zonule, such as Helmholtz thought obtained in accommodation, to have the lenticonus as a result which Tscherning has practically demonstrated. Tscherning's theory on the other hand does not seem adequate to explain the phenomena which undoubtedly occur. Long before Bowman's discovery of the long fibres of the ciliary muscle, or of Müller's of the circular ones, it was believed that the large vascular plexuses constituting the ciliary processes and which from their very bulk occupied so much of the limited space in this region exercised an influence on accommodation. But when the microscope showed the true structure of the ciliary muscle, the assumption quickly followed that it was to its action alone that all focal changes should be ascribed and that the



ciliary vessels had purely secretory and nutritive functions. When, however, we note the size of these vascular masses, especially large in some of the lower animals, and consider how their bulk would be increased when engorged with blood, it can scarcely be doubted that the resultant pressure would affect the delicate adjustment upon which they actually lie.

The long fibres of the ciliary muscle are attached anteriorly in the sclero-corneal tissue constituting the boundary wall of Schlemm's canal. They are attached posteriorly to the choroid. The fibres of Müller form the angular ring beneath those of Bowman.

The physiologic action which follows would almost seem obvious. A contraction of the long fibres relaxes the zonule. Coincidentally with this, the circular fibres surrounding the margin of the iris contract, impeding the free venous flow and causing the ciliary processes to become turgid with blood, they in turn pressing, by their bulk, on the anterior part of the suspensory ligament of necessity flatten the edges and protrude the center of the lens in exactly the form that catoptric tests have shown to be present.

Accommodation having been completed, the muscles relax allowing the vessels which had been full, to empty, in all probability in doing so allowing the overflow to pass into Schlemm's canal.

It will be evident from this that as the artery leads by way of a very large capillary into the anastomosing mass of veins that the passage of blood into the capillary processes is practically unimpeded. That an increase in bulk in the ciliary region occurs in accommodation, has been noted by Tscherning who does not ascribe it, however, to the cause which I have given. He says, "There is formed during accommodation at the anterior surface of the iris a circular depression—the peripheral border of which corresponding to the ciliary body rises in a peak while the central border presents a very gentle slope corresponding to the anterior surface of the crystalline lens."

In order to understand the mechanism of binocular vision, it is necessary to predicate not only a cortical macula but for each terminal retinal element a corresponding neuron in the visual center. We have, then, two overlapping impressions

requiring exact adjustment in order that the foci may be clearly defined in every meridian of each area. That this nicety of adjustment may be maintained it is not alone necessary that the angle of fusion, as Nagel calls it, shall be correctly balanced, but that every retinal meridian shall be so focused that, if possible, a visual image free from distortion shall result. With both corneæ nonastigmatic to obtain such a perfect visual impression requires the co-operative efforts of all the extrinsic muscles and both the ciliary bodies. Paralysis of the nerve supplying any one of these muscles will make such a result impossible. Perfect vision, however, as nearly as it can be measured, is also obtained when the corneæ are moderately astigmatic and in occasional instances when marked differences in the radii of the corneal meridians are present. It does not seem possible that this could be produced by rapidly alternating the meridians through which the approximately perfect vision can be obtained, which is the usual explanation of this phenomenon. Moreover, it is a well authenticated fact that the astigmatic angle changes under a cycloplegic.

Tscherning accepts the idea that it is possible by exerting traction on the suspensory ligament on opposite sides through the same meridian to make a lens astigmatic, and quotes in a foot-note in his *Physiologic Optics* the interesting experiment of Stadfeldt upon a lens freshly removed from the human eye. "In consequence of traction" in opposite direction "he always caused astigmatism, the maximum of curvature corresponding to the direction of the traction. On a crystal-line lens belonging to a person aged 38 years he thus produced an astigmatism of the anterior surface of 4 diopters. The posterior surface was very slightly influenced. The astigmatism disappeared with the traction."

These facts justify the belief that accommodation is not always produced by the action of the entire ciliary body, but that opposing segments in the same meridian may in whole or in part correct the opposing corneal deformity. The number of ciliary processes is not uniform in all eyes. There are usually about seventy-two, which would divide the corneal periphery into arcs of five degrees each, as small a division of the circle as is necessary for an astigmatic correction.

In normal accommodation, then, there must be a conjugate action of the part of each ciliary neuron with the corresponding neuron in the fellow eye. In astigmatism nervous energy would be carried to corresponding groups in the two arcs of the same meridian in each eye and in unsymmetric astigmatism to disassociated groups in unsymmetric meridians.

This explanation of the ciliary activities makes it quite possible to understand the development of sympathetic ophthalmia with an absence of infectious germs.\* A traumatism involving a ciliary segment in one eye causes a persistent irritation at the point of injury. Since there is a conjugate action on the part of each process with the corresponding process in the fellow eye, the excess of energy transmitted to the one eye is also sent to the other and the sympathetic irritation becomes an inflammation or a cyclitis. As the nutritive conditions of the lens are dependent upon the smoothness with which the ciliary processes fill and empty themselves, refractive errors, especially when astigmatic, interrupt its normal lymph supply and, if not the direct cause of cataract, are not rarely an important element in its development.

Now, if the idea to which I have given expression be the true one, that the ciliary *processes* constitute true erectile tissue and enter as an essential element into the accommodative act, a series of pathologic events may be explained in logic sequence, for is it not the irritation of muscular effort that would result from any form of eyestrain but a venous stasis involving the veritable physiologic center of the eye.

After years of controversy, Schwalbe's contention that Schlemm's canal is a venous reservoir serving to receive the overflow from the active ciliary processes has now been very generally accepted as practically proven.†

It would follow, then, that any undue or irregular accommodative effort would produce a passive ciliary congestion rather than an irritation. This would involve the *venæ vorticosæ*.

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\*Ayres and Alt, *American Journal of Ophthalmology*, Feb. 1898.

†See "System of Diseases of the Eye," Norris and Oliver, p. 250.

Since convergence and accommodation are coincident they must for their normal accomplishment require a perfect balance of all of the muscles entering into the visual act. Excessive strength either anatomic or dynamic on the part of the externi causes undue effort on the part of the interni with ciliary spasm, which is congestion of the ciliary processes. We will look then in malignant myopia not to the refraction alone but to the muscular imbalance before the progress of the disease shall be halted. As the nutritive channels arise from the same source the same cause might under other conditions in the young, cause like degenerate changes in the anterior part of the eye producing conical cornea and in the adult, glaucoma. It is not the purpose of this paper to discuss these possible resultant changes, but to urge the importance of the vascular element in accommodation and to point out the long and important line of ocular lesions which may find adequate explanation in this theory.

Indeed, accepting the theory of the segmental and conjugate action of the ciliary muscles together with the associated action of the ciliary processes as an essential element in accommodation, we have an intelligent explanation of the causes of inflammatory and degenerative changes within the eye dependent upon astigmatic conditions and muscular imbalances and through the same causes by disassociations of correlated brain centers of irritative, nutritional and psychic disturbances involving other and remote organs.

#### DISCUSSION.

DR. LUCIEN HOWE (Buffalo): It strikes me that our early masters in ophthalmology and students of this subject are after all not so far apart from each other in their conclusions. The evidence tends to show that the contraction of the ciliary muscle is to relax the zonula. In spite of that, however, we must regard the accommodation as essentially an active effort.

Hess says if you take the eye of a child and dissect it out and draw on the ciliary processes, you can get reflections from the anterior and posterior surfaces and notice what effect traction has on the shape of the lens. The eye of an ox or a hog can be used for that.

Another point in regard to the position of the lens: We usually think of this as being placed exactly perpendicular to the axis of vision; that however is not the case—it is ordinarily tipped temporalward, or also a little forward. If you doubt that, take the ordinary ophthalmometer and remove the prisms, thus converting the instrument into a telescope, and the reflections from the lens show clearly its abnormal position.

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### SOME OF THE ACCIDENTS AND COMPLICATIONS MET WITH IN THE EXTRACTION OF CATARACT.

By D. W. GREENE, M.D.,  
DAYTON, OHIO.

THE writer has enjoyed unusual opportunities during the past twenty years for observing the process of opacification of the lens in a large number of men past middle life, and also to have made upward of one thousand extractions of the lens in private and in hospital practice and in the “eye wards” of the the hospital at the National Military Home, near his home city, after different methods and under different conditions. This experience has given him the opportunity to judge of the relative merits of the different operations usually employed and to select those best suited to the class of cases he meets with.

The purpose of this paper is to treat of accidents and complications, as he has seen and treated them.

A well conceived and properly executed extraction is probably the acme of surgical skill. No other operation approaches it in definiteness of conception, delicacy of execution, in the nicety with which the different steps are carried out, the object to be attained, and lastly the contentment and joy it has brought to humanity. Other operations relieve suffering, some prolong life, and some correct deformity, but the extraction of the opaque lens does all of these and more. Unfortunately this ideal is not always realized by operation. Accidents and complications confront us on every side, and sometimes defeat our best endeavors for the restoration of vision.

Going briefly into a historical review of the operation, in 1706, Petit, as I understand it, was the first to extract the lens (not a cataract) for restoration of vision—a dislocated opaque lens, from the anterior chamber, through an incision not definitely located, but probably corneal, made with a large needle for the puncture, and scissors to complete the section. The credit of priority in extracting the lens is usually given to Daviel, in fact a monument stands in a little cemetery about two miles northeast from Geneva, Switzerland, commemorative of this claim. Daviel himself has given the credit of priority to Petit, but there can be no question, I think, that the credit of operating for cataract, by extraction, for restoration of vision, within historic times, belongs to Daviel, 1745. Beer and others followed him and added iridectomy and, best of all, Beer devised the triangular knife which bears his name, and has been the most important factor in the evolution of the flap operation, since it enabled the operator to make the section with one instrument, which had not been possible up to his time. While the operation and the knife are seldom used now, the lessons to be learned from its use and the principles involved in its execution have been of great value. (Waldau's scoop-extraction with small corneal section, in 1860, was another step in the evolution of the operation).

Mooren's flap section and preliminary iridectomy in 1862, and Jacobson's method, followed about the same time.

This brings us down to 1865, a period of 120 years in which all extractions were made after the method of Daviel, with all the accidents and complications inherent in the method, due largely to the great size and peripheral location of the incision and the bruising of the iris in delivering the lens, and a lack of knowledge of aseptic precaution for the prevention of wound infection, and lastly, the local anæsthetic power of cocaine was not known.

Von Graefe's linear extraction with the long, narrow knife which bears his name, came into general use after 1865. It was soon found desirable, on account of accidents and complications which occurred, to shift the line of the incision from the edge of the sclera forward into the cornea and combine an iridectomy with it, as Desmarres had done since 1856.

This brief review is not intended to go more deeply into the subject than seems necessary to illustrate the title of the paper, and show that many of the accidents and many of the complications were inherent in the methods themselves and in the want of knowledge of pathological processes as illustrated in wound infection—the *bête noir* of all operations. It could easily be shown that accidents are not so common and complications not so serious as in former times, but these facts are self-evident and need not be repeated here. The simple operation as made to-day is essentially that of Daviel, except that the incision is made upward and with one knife. The combined operation is made in all respects just as it came from the hand of Von Graefe, with the single exception that the incision is shifted and is now made within the cornea. Truly there is little that is new in cataract extraction. The eye is a small organ, and, it would seem, has been exploited surgically to about the limit, that is to say the number and kind of operations it will admit of has been about reached; henceforth it would seem that the application of the principles that underlie these operations and their adaptation to different conditions, attention to the preparation of the patient, attention to the carrying out of details, and the care of accidents and complications as they arise, will be the portion of future operators.

No arbitrary definition of accidents and complications can be given, nor a rigid distinction made between them, but for our purpose it will be sufficient to regard accidents as preventable happenings. In other words, they are some departures from the usual steps of an operation which should not have occurred, for which the operator, as a rule, is responsible. Accidents are operative, and occur during the different steps of the operation. Introducing the knife upside down, while not an accident of frequent occurrence, happens to all men who do much operating. It is inexcusable and ought never to occur, to an operator of good vision, and need not if we would be careful to look for the name of the maker which is usually stamped on the back of the knife handle, and is a good guide to the location of the cutting edge. Fortunately it is not a serious accident. By withdrawing the knife and waiting for fifteen to twenty minutes,

the chamber will have filled again and we can proceed as if nothing had happened. Turning the knife without withdrawing has been tried, but the aqueous escapes, the chamber is abolished, the iris falls over the blade of the knife, and a counter-puncture cannot be made without doing damage to the iris; therefore this plan has been partially abandoned. The aqueous is allowed to collect and then proceed as if nothing had happened out of the ordinary.\* Failure to enter the anterior chamber with the point of the knife and pushing it through the lamellæ of the cornea can easily happen to the inexperienced operator, and a section made too angling through the cornea, will leave a broad linear opacity.

Probably the most frequent accident met with is that of making the section too small for easy and gentle delivery of the lens. In the writer's experience, it has happened from one of three causes: first, failure to appreciate the relative size of the lens to the diameter of the cornea; second, from rotation of the globe on its axis, from pressure in making the puncture and passing the knife through the anterior chamber for the counter-puncture. (If the knife is sharp this is not likely to occur). Third, from making the section so slowly that the aqueous escapes, the iris falls over the blade of the knife and the position of the point when counter-puncture is made cannot be seen. If the section proves too small it should be enlarged with scissors sufficiently to admit of easy delivery of the lens, for it is far better to have too large an incision than to force the lens through an insufficient opening and bruise the angles of the incision, entangle the iris, and strip off cortical matter. The angles are favorite starting points for infective processes, and cortical debris cannot always be seen until it becomes opaque. It is not always absorbed, but may become organized and then must be dealt with surgically at a later date. Hæmorrhage into the anterior chamber may come from the incision being too far back in the corneo-scleral junction. It may occur on completion of the section or after the iridectomy has been

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\* Since this paper was read the writer has had this accident happen to him again. It was remedied by making the counter-puncture quickly, rotating the knife and completing the section quickly. And he has lately seen the same accident happen to Dr. Knapp in New York, who treated it in the same way.



made. Previous inflammation from any cause, operating to increase congestion in the anterior segment of the globe, predisposes to it. It is seldom serious enough to interfere with the subsequent steps of the operation, and if removed quickly by pressure with spatula before it coagulates, time is given to deliver the lens, the pressure of which usually stops the hæmorrhage. If it still persists, a sterile solution of adrenalin may be injected. The presence of the hæmorrhagic diathesis complicates the situation.

The iris falling over the knife while making section usually occurs from one of two causes, or both operating together. High normal tension, or making the section too slowly. The writer has not had much trouble from this accident since he adopted the plan of turning the blade of the knife forward, when it occurs, at an angle of from 60 to 70 degrees, and pressing backward with the back of the blade while the section is completed in the usual sawing manner. The same manœuvre serves a good purpose in preventing this accident in cases of mature cataract where the process of opacification is just completed and the swelling of the lens obliterates the anterior chamber and it is not desirable to wait for shrinking.

Statistics show that prolapse of iris occurs in from three to ten per cent. of cases among the best operators and with the average class of patients. In our last 100 simple operations, we had this accident occur in ten cases. This is too high a per cent., and we have sought an explanation of it, in the character of the patients we have to deal with. As a rule they are not good subjects for operation. Many are broken in health and feeble in mind from dissipation and other vices.

The danger seems, to a certain extent, inherent in the operation itself, and also to the unknown condition that causes one patient to have higher (normal) tension and greater tendency to prolapse than another, and not to the operator; if it were otherwise, we could name a long list of experienced men who ought not to meet with these accidents, but they tell us they do meet with them—therefore it seems reasonable to conclude that the cause of their occurrence is fundamental, inherent in the method itself, or rather in the principles that underlie its performance and the causes given

above. This view is emphasized by the fact that the accident in the modified form of entanglement is seldom met with after a well executed combined operation when careful attention has been given to details and to the so-called toilet after the operation.

The writer prefers the combined operation for the class of patients on whom most of his operations have been performed, and makes it in the great majority of cases. The objections urged against it that it mutilates the iris and furnishes a focus for infection there, is more than offset in his judgment by the difficulties encountered (in delivering the lens and the accidents entailed) in the simple operation. But he is always ready to make the simple operation when the case seems suitable for it. This point is usually decided by the behavior of the iris, when the section is completed. If it prolapses, it is returned and smoothed out with a spatula; if it is retained, eserine is used and the bandage applied. In two or three hours the eye is again inspected. If the iris is in place the bandage is re-applied. If, however, it is found prolapsed, the speculum is introduced and entrusted to the hands of the assistant who lifts the lids away from the eyeball in the manner detailed elsewhere. If vitreous has been lost or is presenting, the speculum is dispensed with entirely and the assistant holds the lids apart while an iridectomy is made, the bandage is applied again, and the eye is not opened for twenty-four hours. Then if the anterior chamber is established, atropia is used; if the pupil dilates, it is repeated again in twenty-four hours. If it does not dilate, it is not repeated. It can do no further good, and in strong solution (4 per cent.) its action will last for twenty-four hours more, when there is usually no further need. The writer always uses this strength of solution in post-operative cases; by turning the head to one side and making pressure over the canaliculi he has never seen constitutional symptoms more formidable than dryness of the throat.

Loss of vitreous has happened to the writer, unfortunately, eleven times in his last 100 cases, nine times after the combined and twice after the simple operation. In no case was the loss sufficient to put the case in immediate jeopardy, and the lowest vision obtained was one-tenth with correction.

In three of the eleven cases the simple operation had been attempted, but because of low tension and difficulty in delivering the lens, iridectomy was made, and delivery in the usual way with vitreous loss after the lens had been delivered.

In three cases loss occurred from straining during the operation. Three more lost vitreous in delivering the lens by hook; and in two more it was lost in delivering the lens in the capsule.

The writer has sought an explanation of the frequent occurrence of prolapse of iris and loss of vitreous, on this hypothesis: that given the type of skull in which the orbital cavities angle so far outward to the plane of the face, the recti muscles, acting within the muscular cone, exert an undue compression or traction on the eyeballs and cause the incision to gap. In such a contingency he believes these accidents very liable to happen. Some such explanation it is generally believed is capable of explaining the spontaneous cure of strabismus, and some such explanation seems necessary to explain the occurrence of prolapse and vitreous loss when no other cause for their occurrence is manifest, after excluding rough handling during the operation and high (normal) tension. In this connection reference is made to patients with very prominent eyeballs and orbital cavities noted above, where the speculum may make undue pressure and cause iris prolapse or vitreous loss, and also to those patients with small, deeply set eyes, with heavy, overhanging brows, where loss of vitreous may occur from the manipulation necessary to deliver the lens, especially if it is fluid, or rather not of normal consistency.

The lens is easily dislocated during the performance of capsulotomy if the cystotome is not sharp and undue pressure is required to open the capsule, or if an attempt is made to extract the anterior leaf. The accident usually happens in hypermature cataract where the capsule is found tough and thickened, from changes which begin after the maturity of the cataract. The causes that operate to produce this condition seems to have a different effect on the zonula. It is found fragile and easily ruptured; in such a condition the lens can be easily extracted in the capsule, and this method of dealing with it is generally followed.

We all meet with difficulties in delivering the lens. In the writer's experience it occurs more frequently from the section being too small, from minus tension, from failure to open the capsule, and from failure to make the requisite pressure on the posterior lip of the section while pressure is made from below the cornea in order to cause the lens to engage in the wound. In the simple operation where the pupil seems rigid, the delivery is aided by stripping back the edge of the pupil over the presenting lens, which then engages it. If this manipulation does not succeed and vitreous presents or escapes, a scoop or hook should be passed into the eye and the lens delivered. The writer prefers a sharp hook; it is smaller, more easily introduced and when the point is engaged in the hard nucleus it cannot slip away as is so likely to happen when a scoop is used.

When plus tension is present or the normal tension for the individual is high, the section should be made slowly so that the aqueous does not gush out, the iris prolapses, and the lens escapes too quickly. I have never had a hæmorrhage into the vitreous or a serious hæmorrhage of any kind and am disposed to attribute this good fortune to the attention given to preventing too rapid delivery of the lens by holding it back with a scoop or wire loop. This simple manœuvre has seemed to be of good service in the cases where it has been tried. The writer understands that this suggestion is not new, but is of sufficient importance to be emphasized.

Some years ago this accident happened in operating on a stout, well developed soldier, who had a round, red face and prominent eyeballs with apparently too diverging axes of the orbital cavities such as I have described under the causes for loss of vitreous earlier in the paper. He began squeezing on completion of the iridectomy, the speculum was securely locked and did not yield. His face became intensely livid and his eyeball advanced until the upper blade of the speculum sprang the wound; the lens was forced out in the capsule and the vitreous body followed. Of course the eye was lost. Two years later, the other eye was operated under general anæsthesia and made a good recovery with vision equal to  $\frac{20}{30}$  with correction. In this class of cases and in all others where the patient from nervousness, fright or disease, has not good

control of himself, a general anæsthetic should be given.

In all cases of hypermature cataract and in all other cases where loss of vitreous is threatened or has already occurred, the assistant is trained to take hold of the speculum at its end and elevate it and the eyelids from the globe. This is a favorite method with the writer and has served him well in several emergencies.

Two years ago while operating before some invited guests of our state Medical Society, the writer met with an unusual accident. The abscision of the iris, as he thought, was completed. This proved not to be so, a small tag remaining unseparated. In the withdrawal of the forceps one-half of the remaining iris was torn away from its ciliary attachment. It was drawn out and abscised and the patient made a good recovery—vision equal to  $\frac{3}{10}$  with +12.

Some years ago in making a double operation on an old gentleman with hypermature cataracts, by the combined method, the nuclei could not be delivered and were given up as lost. In the first eye a thin and attenuated nucleus came from under the upper lid with the speculum where it had been carried by the gush of milky cortex. In the second eye the nucleus was taken from under the upper lid where it gave rise to the feeling of a foreign body after the bandage had been applied.

One of my patients was a gentleman from the center of our state whose right eye had been operated upon and lost from suppuration. At that time making a preliminary iridectomy was thought to be the proper procedure when the cataract was immature. The incision was made with a large triangular keratome, and a medium sized segment of iris abscised. After five days he returned home, a distance of seventy miles, by train. In a few days a letter came stating that he had had severe pain the night before, which was better at the time of writing, but that there was considerable tearing of the eye and a feeling as of a foreign body under the eyelid. He was directed to come down immediately. He drove six miles in a buggy, returning here by train, and then walked two blocks to my office. When the lid was raised it revealed the corneal incision opened by the pressure of the swollen lens which was well engaged in it. At the

hospital all that was needed for the delivery of the lens was clipping each angle with the scissors. The patient made an uneventful recovery; the vision was equal to  $\frac{20}{40}$  with correction. There was no history of injury to the eye while at home, but what probably occurred was a small injury to the capsule from the point of the keratome or from the forceps in catching the iris. The swelling of the lens followed, the tension became plus, the wound sprang open and practically spontaneous delivery of the lens occurred.

Complications are usually post-operative, but not always so. A distinction can be made between those that complicate the operation and those that complicate and delay the healing and recovery afterward. It is not always possible to differentiate between an accident and a complication. For our purpose, however, it is desirable to make a distinction between them, and we have tried to do so not by hard and fast lines but rather by grouping together in their order of occurrence and importance the different conditions that enter into and determine the outcome of the case. Of the conditions that complicate the operation we may group under corneal opacities every form of disease that affects its transparency, reserving for some later remarks, infective processes that follow operations. Under diseases of the iris synechiæ, occlusion and seclusion of the pupil, and later on we will speak of infective processes which sometimes follow. Under diseases of the lens hypermaturity, dislocation and thickening of the leaves of the capsule and friability of the zonula; under diseases of the vitreous, fluidity, opacity and infection. Under diseases of the retina and choroid we may include high degrees of myopia and retinal detachment and the various forms of inflammation met with in Bright's disease, diabetes and leukaemia.

If delirium and hallucinations are present, we remove the bandage, and if atropia is being used, stop it and give sedatives. Fright requires comforting assurance; paralysis agitans will sometimes require an anæsthetic. If an attack of epilepsy occurs during the operation, an anæsthetic will be required to complete it.

Of the conditions that delay and complicate the healing, the most frequent is iritis; in varying degrees of intensity it

is present in at least one-half of all cases, at some stage of the healing. It is generally of a mild type and yields to atropia, dionin, hot water and leeching. Occasionally it is of a severe type and an exudate is thrown out which closes the pupil or coloboma. If the patient is syphilitic, it will probably be absorbed under appropriate treatment. If rheumatism or gout are present, large doses of sodium salicylate and colchicum will usually relieve the pain and cause its absorption. If we fail with this, it will become organized and must be dealt with surgically to secure an opening through it. Opacity of the capsule from irido-capsulitis occasionally occurs and requires the same surgical treatment. Pain coming on during night, ten or twelve hours after the operation, at a time when all smarting due to it should have ceased, is a very suspicious symptom, and usually means infection of the wound, due in the vast majority of cases to undetected or overlooked lacrimal disease. Infection means auto-infection nine times in ten. Sympathetic inflammation is a complication that we have not met. Delayed union has been seen several times. We have had one case go fourteen days and heal without other treatment than the bandage. The writer believes that much anxiety and useless meddling would be avoided by letting this complication alone as a rule of practice, to which there may occasionally be exceptions.

Astigmatism is a common complication, varying from 3 to 20 diopters immediately after the operation, to about 1 diopter in a few months afterward. If the incision has been made with a sharp, keen knife, primary union occurs and the degree is low; if, however, the knife is not sharp, the incision will be ragged and the inflammation may occur and healing with higher degree of astigmatism may result, or high tension may come on and spring the wound and cause the iris to prolapse or a tag of capsule to insinuate itself in the wound and a high degree of astigmatism will result. Nature offers all the relief we can hope for in this condition, after the prolapsed iris has been abscised and proper glasses have been given.

Septic infection, next to hæmorrhage into the vitreous, is the most serious complication that can arise. It usually starts in the corneal incision, which becomes infiltrated.

The edges may slough and, if the infection is intense, it may spread to the whole of the cornea. Or it may start as an infection of the iris (suppurative iritis), or as an inflammation of the vitreous body (suppurative hyalitis)—suppurative retinitis or choroiditis may also occur; but these are never primary diseases after an operation, as I understand it.

The writer has met with one case of fistulous healing. It followed a simple extraction in which the prolapse was also abscised within twenty-four hours; yet it resisted all attempts at healing, and persists to this time.

A great deal is being written now about the power of cocaine to cause in old persons softness and collapse of the cornea, and thus to complicate the operation of extraction. As pertinent to the question, and also bearing on the matter of priority in observing this property of cocaine, I beg to submit the following record from the eye-ward of the National Military Home, December 10, 1884, which the writer dictated. "Wm. H. Hood, K. 5th, U. S. C. T: Cataract extracted under cocaine hydrochlorate anæsthesia; two or three drops of the 2 per cent. solution were used at intervals until eight drops were used in twelve minutes, at the end of which time the operation was performed without pain. After the aqueous humor escaped the cornea collapsed, becoming funnel shaped and causing the extraction of the cataract to be very difficult, and after the operation was completed, the anterior chamber did not fill as it usually does, and had not filled when the bandage was applied; but next day the aqueous had filled the chamber and the case looked very hopeful. It is a question whether hydrochlorate of cocaine did not cause this collapse."

The writer has not tried to present a statistical report covering accidents and complications, but has simply related his personal experience in treating and avoiding the more important ones, as he has met them.

Convinced that some of the most valuable, lasting and helpful acquisitions to our knowledge have come, and must still come through personal experience, he respectfully submits the paper as a small contribution to that end.



DISCUSSION ON  
THE LENS CAPSULE IN OPERATION FOR CATARACT,\*  
BY DR. H. KNAPP,  
AND  
SOME OF THE ACCIDENTS AND COMPLICATIONS MET WITH  
IN CATARACT EXTRACTION,  
BY D. W. GREENE.

DR. JOHN E. WEEKS (New York): The subject of cataract extraction and the treatment of the capsule is so extensive that detailed discussion would occupy much more time than we are permitted. I shall therefore speak of but a few points. In regard to the incision, I infer from a synopsis of the paper first read that the author's incision is corneal. I think the incision that gives the best result is the incision made in the vascular portion of the eye—the limbus, and the making of a conjunctival flap. Another point is the removal of a portion of the capsule. I fully agree with Dr. Knapp that the removal of the anterior portion is difficult and apt to cause complications. I have tried a number of instruments for this purpose, but none have been perfectly satisfactory. In regard to the capsulotomy, I think that the method of opening the capsule advocated by Dr. Knapp is extremely good, but it is not free from objections. The capsule is not infrequently torn by the lens as it escapes and you do not get a simple linear incision in all of the cases. As Dr. Knapp has said, wherever the capsule is opened there is a scar and thickened line which makes the subsequent capsulotomy relatively difficult. If we can get an opening which will lay bare the posterior portion of the capsule, as is often accomplished by the Graefe capsulotomy, subsequent operation, if necessary, is comparatively easy and simple. In many cases a secondary operation ("needling") is not necessary. Where the margins of the torn capsule come in contact with the iris there is apt to be an adhesion—posterior synechia. As a rule this amounts to nothing, but it is advisable to prevent it as much as possible.

With regard to the combined or simple operation, it has often occurred to me to put the question to myself, if I had a cataract, which operation would I select? I think that I

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\* See page 4.

should select the combined operation. A large experience with both methods has led me to believe that the complications that may follow the simple operation are more serious than those that may follow the combined operation.

DR. EDWARD JACKSON (Denver): For several years I have done the opening of the capsule in this way: After completing the corneal section, if I intend doing simple extraction, or after turning down the conjunctival flap from the cornea—for I aim to get some flap at the center—I dip the cataract knife into a pitcher of boiling water held by the nurse at my elbow, then introduce the back of the knife into the corneal section, drawing it back toward the point of original puncture. After an iridectomy, added space is secured by the iridectomy; but in even simple operation, with a small pupil, it is not difficult to do this. Bring the knife to the side of the pupil nearest the original corneal puncture, allow the back of the knife to press on the iris and retract it some distance; then make a puncture in the lens capsule with the point of the knife. Carry the point of the knife forward to the other side of the pupil and even cut the capsule back of the iris, without injuring the iris. Withdraw the knife, and that completes the opening of the capsule. I first undertook this method of opening the capsule fearing that the result of such a manœuvre would be an inadequate opening, that the capsule would offer resistance to the extraction of the lens. I never have been conscious of the slightest resistance after such an incision except in two cases in which the cataract was hypermature and the capsule unusually thickened. Whether the incision splits from the ends and extends out to the edge of the lens, or whether the stretching is sufficient to permit of the nucleus passing through it I cannot say; but the fact is that after such an incision, which is not difficult to make, the lens comes out without difficulty. The results have been all that Dr. Knapp has claimed for his incision. It is of the same kind, but not quite so peripheral as his. There are sometimes adhesions at the points where the incision would cross the pupil, but they give very little trouble, and the scar, if there is a noticeable one, is out of the way of the central pupillary region. I am sure that the number of cases requiring a secondary operation has been rather smaller since

I adopted this plan. Some of the cases have been watched from time to time during ten years. I have operated upon something like 300 cases by this method. I have not encountered any serious difficulty, and the results have been a capsule that is easy to deal with if it requires subsequent attention.

DR. A. A. HUBBEL (Buffalo): My experience has now been sufficient to warrant me in saying a word on this subject. It is an important one, and none of us, in five minutes, can discuss any part of it fully. I wish to speak, first, as to the manner of making the incision. I believe that the original incision of Daviel is ideal, except that he made it downward instead of upward. It is made directly in the corneo-scleral junction, and should be large enough to give easy egress to the lens. I do not like to go back into the conjunctiva very much, because there is thus a liability of getting hæmorrhage into the anterior chamber, which adds to the difficulty of properly opening the capsule. The question has been uppermost in my mind for a number of years as to whether I should do the simple or combined operation. Of course all of us have been tempted to do the simple operation, but it has its drawbacks, and to my mind they are in excess of those of the combined operation. I agree with Dr. Weeks, that if I had a cataract and it was to be removed, I should prefer to have it done by the combined method. I wish to call attention to the method of "button-holing" the iris, practiced by the surgeons of the Massachusetts Eye Infirmary of Boston. The operation is done after the simple operation is completed, when, with a delicate forceps the iris is grasped as near the periphery as possible and a small fold is brought out and excised—the smallest possible portion. I have been doing this during the past summer, and, while my experience has not been large, it is very satisfactory. It is somewhat difficult to do, as the patient's eye must be still, and as it is not easy to limit the amount of iris to be excised. I believe the prolapse of the iris in simple extraction is due more to the pressure of the aqueous humor from behind than to any other cause. This button-hole operation leaves an opening through which the aqueous passes, and it does not collect beneath the iris to press it out before the union of the corneal wound takes place.

The treatment of the capsule is another important subject, and much might be said in regard to it. I have tried Dr. Eugene Smith's capsule forceps, but I have not been very successful in using them. The fault is doubtless mine. I have tried Dr. Knapp's and other methods, but have come back to making the T-shaped incision of Graefe, as described here to-day. After the lens is extracted, irrigate the anterior chamber according to the method recommended by Lippincott of Pittsburgh. I have used his treatment for two years and I believe that increased success will come from practicing this or some other method of irrigation. It is done easily, the lens and blood-debris is thus removed, and little is left to produce opacities, or to cause irritation and inflammation.

DR. EUGENE SMITH (Detroit): The method of button-holing the iris has been used a hundred years more or less. It is a simple thing to remove the anterior capsule; I have been doing it for twenty years in every instance. As it has been remarked, we not infrequently deliver the entire lens in its capsule, and without loss of vitreous when the capsule is thickened. In regard to Dr. Knapp's forceps, it is a little difficult to make them bite; the blades come together, and if you are not careful you will pinch up a fold of the iris. The teeth should come together and yet leave a little opening between the blades as in my forceps. I prefer a little drop to the portion of the blades containing the teeth. They drop into the pupillary space while the blades are on a plane with the iris. I have examined the capsule extracted with the microscope and have observed that it measures 3x5 mm. I have never seen a lens dislocated. There is no necessity of making such deep pressure. I have had to make discission of the capsule in less than 3 per cent. of my operations. I have had the little adhesions that you are bound to have with whatever operation you make. You will get posterior synechiæ—you cannot help it. Regarding the prolapse of the iris, I read a paper at the last meeting of this Academy regarding the hypodermic use of morphine after operation. I have used it for fifteen to eighteen years, and I have operated on many cases. I prefer the simple extraction in suitable cases, but always in my simple cases the hypodermic injection of morphia,  $\frac{1}{8}$  of a grain every three hours until

three doses are given. I use eserine also when finishing the toilet. I am a strong advocate of the use of capsule forceps, and morphia in simple extraction. I use the capsule forceps in all cases.

DR. ALBERT R. BAKER (Cleveland): I wish to add my testimony in favor of the peripheral capsulotomy of Dr. Knapp, which was the first one I made and the last one. I have tried the capsule forceps of Dr. Smith, and I think I have tried them all, but I find that after a few trials I go back to the peripheral opening of the capsule of the lens. I do not see that I have to make any more secondary operations when I make the incision than when I make any other.

With regard to accidents, the escape of vitreous is the one I have always feared the most, and have frequently attributed it to the awkwardness of my assistant. To avoid this difficulty, I adopted several years ago a plan of operation, which is not original, and that is of discarding the speculum and grasping the superior rectus above the cornea with the fixation forceps instead of below, thus holding the upper lid out of the way with my forceps. It is surprising how easily and how accurately the incision can be made with almost no fear of escape of vitreous from pressure or pulling upon the eyeball by assistant or squeezing the lids together on the speculum by the patient.

DR. JOSEPH E. WILLETTTS (Pittsburgh): It seems to me that the best operation is that operation by which the lens may be extracted in the quickest possible time, with the least interference to the eye. This is unquestionably accomplished by the simple extraction. I have been present at some fifty odd consecutive operations by Dr. Knapp, in which the lens was extracted by the simple method, the capsulotomy being peripheral; and since that time I have advocated the simple extraction and operated by that method exclusively. I prefer the incision through the corneo-scleral margin. The capsulotomy which Dr. Knapp recommends, I do not like, probably because I am not as fond of doing dissections as he is. I make a central capsulotomy, crucial in shape. It seems to me it is bad surgery to do a preliminary iridectomy, when it is not essential to results to be obtained, and it is equally bad to do peripheral capsulotomy, which almost invariably

necessitates a dissection. I am not in favor of subjecting an eye to three distinct operations, where one suffices.

DR. HERMANN KNAPP (closing discussion of his paper): (Dr. Knapp illustrates at the blackboard). When you look sharp at the exit of the lens through the pupil you see that the edge of the iris is notched, but the little angles disappear when the lens is out. These little ruptures of the iris come in contact with the shreds of the torn capsule of the lens and produce synechiæ. When I was in Vienna years ago, Prof. Arlt said he had never seen them, but when I looked at his patients with oblique light I found that there were a number of them, and he said, "Yes, they are agglutinations and have nothing to signify." When these ruptures of the iris come in contact with raw surfaces of the shreds of lens capsule we get the adhesions. If the lens comes out in its capsule, we notice no synechiæ, but we find them regularly if the anterior capsule is miscellaneously ruptured with a cystotome or other instrument. The synechiæ, I think, are ever inflammatory. Under all conditions they are better absent than present. In order to avoid them, I have for many years placed the opening of the capsule to the periphery of the capsule, about 1 mm. in front, and parallel with the corneal section. This keeps them off nearly always. Another advantage is that the anterior and posterior capsules agglutinate and are free from inflammatory thickenings, so that the capsulotome can split it easily, with better permanent acuteness of sight.

DR. GREENE (closing discussion of his paper): I have not much to say. In regard to the incision Dr. Weeks speaks of, I have tried to make it as seen in Paris—a corneal section starting well back. I have never made a conjunctival flap. I have never seen cases where I thought it would do good. The extraction of the anterior capsule is easy. I saw Fuchs do it in 1888 and have seen many since, and it is very easy. I know of nothing easier. I have a record of 150 operations after I had studied at the feet of Dr. Knapp of New York, after his method. I do not like it, and abandoned it because of the necessity of needling that followed. All the cases of glaucoma I have had, excepting two, have followed needling. I dread the needling more than extraction, so far as glaucoma is concerned.

## FILARIA LOA.

BY DERRICK T. VAIL, M.D.

CINCINNATI.

ENTOZOA affecting the human eyes are rarely encountered in America, and of these rare guests the most unusual and in many ways the most interesting is the filaria loa. Henry B. Ward, Professor of Helminthology, University of Nebraska, writes me that in over one hundred references which he has carefully searched, he has found but one case where the parasite was actually extracted within the confines of the United States. My case is therefore the second on record in this country. It is claimed that there is only one small section of the world which produces the worm in question. My case was infected in that locality.

The patient, Mrs. A. B. Lippert, Westwood, Cincinnati, whose husband, Dr. A. B. Lippert, is a medical practitioner and missionary in western Africa, 135 miles from the west coast, in the equatorial region, in the country called Kamerun, first consulted me in August, 1901.

History: While residing in Africa in 1899, the patient one day noticed a prickling sensation in the right eye. The sensation was annoying, of the nature of an acupuncture, very positive, causing her to consult her husband at once in regard to it. Examination revealed the bulbar conjunctiva to be somewhat injected on the temporal side and the Doctor noticed a vermiform movement under the conjunctiva external to the sclera, looking very much like a worm crawling under the conjunctiva. At times the movement would cease for a few minutes, to be shortly resumed, "seeming very much like a snake forcing its way through a tangle of grass." In two hours time it had moved off the ball of the eye and escaped in the connective tissue at the outer canthus.

Her husband having heard that "eye worms" were common in that section of country, prepared some instruments for use in case the entozoon would manifest itself again. Two days later the same symptoms occurred in the left eye. The Doctor distinctly saw the worm crawling across the sclerotic of the left eye rather rapidly, and by the time he had the cocaine and instruments ready it had escaped. Within

half an hour it appeared again in the upper eyelid between the skin and the tarsus. He made an incision with a knife over the point of greatest movement and succeeded in extracting the worm by means of dissecting forceps. Six months later another worm appeared in a similar position under the skin of the upper eyelid of the right eye. This time the knife severed the worm near its middle and one-half was extracted, while the other half remained in the tissues. The latter did not move afterward, but left a small nodule in the tissues which one can still see.

Three months after this a worm appeared in the neck over the sterno-cleido muscle on the right side, and could be distinctly seen. The operation was similar in technique, and the worm was extracted. And again, eight months afterwards, a worm was felt and seen in the left mamma, about an inch above the nipple under the skin. This was attacked in the same manner, but was severed and one part removed, with no evidence of what ever became of the remaining part. On another occasion one was felt and seen at the angle of the scapula, but the instruments not being at hand, the worm made its escape.

On various occasions single worms were felt in the eyelid and on the eyeball, her husband removing four at various times, but all were between the tarsus and the external skin of the eyelid. The patient remembers distinctly that the left ankle was affected with a worm, which produced considerable inflammation and œdema; and at the same time the right wrist was similarly affected, but the worms did not come to the surface, and both made their escape. The swelling gradually disappeared, leaving no bad results.

At various and numerous times the patient would feel worms at work near the joints of the body. The patient states that the insertion of a tendon was the principal point of irritation in every instance. Sometimes swelling, tenderness and œdema would accompany the irritation. Within a few hours the worm would be felt to change its position from one extremity of the body—for example, in the ankle—to some remote region like the wrist, of the other side of the body. At times the patient could trace the course of the worm from the ankle to the region of the ribs. The points



of irritation would always be near the head of a bone lying near the skin where the worm passed between.

Examination: On August 9, 1901, the ophthalmic examination was negative; muscular apparatus in good balance; refraction +1.0 right and left; vision  $\frac{20}{20}$ , but patient has considerable asthenopia. There is slight catarrhal conjunctivitis and some blepharitis marginalis. No evidence of any worm was seen about the eyes, excepting the scars at various points, showing where her husband had operated for their extraction.

June 1, 1903. Patient returns, stating that she has again felt these eye worms on several occasions. At times they would be in the eyelids and at other times in the eyeball. Frequently they would be felt about the ankles, the ribs and the wrists. On one occasion she could feel a worm crawling across the sternum. It could be distinctly seen. Her husband being absent at the time, she called her brother, who attempted using a razor, but owing to his untrained surgical ability he only succeeded in making a slight cut, and both patient and surgeon losing confidence, the worm made its escape. She was endeavoring to have him sever it so that both ends would remain quiet and annoy her no further.

On September 17, 1903, while attending to her household duties she felt a worm creeping around on the right eye. Her husband brought her to my office, a distance of five miles, during which time the worm could be distinctly seen moving in the right upper eyelid. Examination at my office at first failed to reveal any evidence of the worm, but as the patient said it would probably manifest itself in a short while, I requested her to remain in my waiting room a few minutes in order to see if it would make itself visible. Before I could get ready to operate, in case the worm manifested itself, I was informed that it was again working near the surface. Examination revealed a distinct, independent movement, like what would be made by a small worm an inch long, crawling about under the skin of the upper eyelid. The movements were slow and somewhat clonic. During one of these contractions I grasped the most prominent loop of the worm by means of fixation forceps and then by means of scissors and forceps succeeded in extracting the worm without its being

severed or wounded. It was placed in alcohol at once and carefully prepared for microscopical examination. The next day the Doctor called, stating that another worm had been seen on the other eye in about the same position, but the patient was not able to come to the office on account of the nervousness following the operation of the day before.

Four months later, viz: January 18, 1904, her husband called, stating that his wife could feel and he could see worm creeping in the skin of the left lower eyelid that morning, but it was not convenient for her to come for its removal. Since last September the patient has felt these worms in various parts of the body.

It has now been two years and eight months since the patient left Africa, and these worms are as active as ever. She declares that she knows of four distinct worms still existing in her body which she feels at various times.

The Doctor is of the opinion that these worms at no time attack the vital organs nor the abdominal or pelvic viscera. They seem to limit their peregrinations to the extremities and especially the tissues about the eyes.

They can almost invariably be felt on chilly days out of season and cold days following a warm spell. If the patient allows her foot or hand to remain from under the bed covering on a cold night the parasite can be felt.

Her general health is good; the vegetative functions are normal and there is no anæmia or cachexia. The patient does not attach much importance to this trouble, excepting that she is naturally anxious to get rid of it on account of her instincts and sensibilities being shocked.

Manson, in his book, "Diseases of Tropical Countries," has the following to say regarding this parasite:

"*FILARIA LOA* (page 517). This parasite is peculiar to the west coast of Africa, where, in many parts, it is not uncommon—in Old Calabar for example. The male worm measures about 25 to 30 mm. in length by 0.3 mm. in breadth; the female 30 to 40 mm. in length by 0.5 mm. in breadth. Both sexes are filiform, cylindrical, colorless, like fine fishing gut, tapering slightly at the head, more decidedly at the tail. The body is dotted over with minute chitinous bosses. The anus is subterminal. The tail of the male is

markedly incurvated and provided with five large papillæ on each side of the anus, and two rather short unequal spicules. The mouth is simple, punctiform and without armature.

“The habitat of *Filaria Loa* appears to be the subcutaneous connective tissue, which it traverses freely. When, in the course of its wanderings, it crosses the subconjunctival connective tissue, and the delicate integuments of the orbit, it becomes distinctly visible. When passing under such thin structures as the skin of the eyelids, or that over the bridge of the nose, or when moving about under the skin of the fingers, the slight elevations it gives rise to, as well as its movements, are sometimes appreciable and may be both seen and felt.

“From the circumstance that this parasite has occasionally been seen in individuals who have been ten or more years away from the endemic area in which alone it can be contracted, we may conclude that the *Loa* is long-lived.

“The female produces embryos closely resembling *filaria nocturna* and *filaria diurna*. At one time I had a negro under my care, in whose blood *filaria diurna* abounded. This man remembered that as a boy he had *Loa* in his eye. On the other hand, Dr. Argyll Robertson has placed on record a remarkable case of *Filaria Loa*, in which the parasites, a male and a pregnant female, were removed from the eye. The patient’s blood was frequently examined but no embryos were found. Lately I had an opportunity of examining the blood of another patient known to be the subject of *Loa* infection, but failed to find any hæmatozoal embryos. We do not know anything about its life history outside of the human body. Notwithstanding the failures to find the embryo in the peripheral blood, analogy suggests that it probably circulates for a time in this fluid and, like *filaria nocturna*, that it is removed from this medium by some suctorial insect which acts as intermediate host.

“*Filaria Loa*, as stated, is very active in wandering about the body, but it seems to have a predilection for the eyes and their neighborhood. It comes and goes there at irregular intervals of days, weeks or months, traversing the subconjunctival tissue, and moving across the bridge of the nose from one eye to the other. Warmth seems to solicit its

presence near the surface. The sexes seem to hunt each other about; at all events, in Dr. Argyll Robertson's case (*Trans. of the Ophthalmological Society*, 1895) a male worm was removed from the eye and not long afterwards a female worm appeared about the same situation and was also removed. The worm gives rise to pricking, itching, creeping sensations and occasionally, transient œdematous swelling in different parts of the body. When it appears under the conjunctiva, it may cause a considerable amount of irritation and congestion. There may be actual pain even, associated with swelling and inability to use the eye, and perhaps tumefaction of the eyelid.

“Treatment: The negroes treat *Filaria Loa* in two ways—either by dropping a grain of common salt into the conjunctival sac, which has the effect of driving the *Filaria* away, for a time at least; or they extract it with a sharp thorn, or by some other rude surgical means.

“With proper instruments there is no difficulty in removing the parasite from under the conjunctiva or from the eyelid—that is, if the operator is possessed of the requisite deftness in operating. All that is necessary, on the parasite showing itself, is, after cocainizing the eye, to seize the conjunctiva with a pair of forceps, taking care to include the worm and the subconjunctival tissue in the grasp of the instrument. Having fixed the parasite in this way, the conjunctiva may be snipped through with scissors; when with the aid of another pair of forceps, and after releasing the first pair, the parasite may be withdrawn. In the case of the parasite showing itself elsewhere, I would suggest that it might be killed, as in the case of the guinea worm, by local hypodermic injection of bichloride of mercury solution (1 in 1000).”

In looking up the subject we find there are many varieties of nematodes, and there is some confusion in classification and nomenclature. Osler in his work on medicine recognizes three species of nematodes under the general term “*Filaria Sanguinis Hominis*.”

(a) *Filaria Bancrofti*: the ordinary blood filaria (not the species found in my case). The embryos of this parasite are found in the peripheral circulation only during sleep

(sometimes called *Filaria Nocturna*). The adult male worm measures over three inches, and the tail forms two turns of a spiral. The female measures over six inches. This is the species which causes Hæmatic Chyluria and Elephantiasis.

(b) *Filaria Diurna*: the larvæ resembling those of the *Filaria Nocturna*. The embryos are found in the peripheral circulation, only during waking hours. Manson thinks that the *Filaria Loa* represents the adult stage.

(c) *Filaria Perstans*: only the embryos are known. They are exceedingly small. Manson declares this worm is the cause of the "sleeping sickness" of negroes. There is a papillo-pustular skin disease found in West Africa called "crawl-crawl," said to be due to this parasite.

One variety has been observed in the anterior chamber of the eye of a horse (Turnbull, Phila., *Med. and Surg. Rec.*, 1878, p. 351). It grew to be four or five inches long, kept up a lively motion and at the last report was still growing. A few similar cases are reported where the worm, several inches long in each instance, was extracted and examined minutely.

Another variety of *Filaria* has been observed in the eye of man (loc. cit.).

Nordman of Odessa, as far back as 1830 and 1831, studied these worms, finding them in the eyes of cattle, sheep, pigs, frogs, lizards, fishes, birds and human beings. In fishes he first found entozoa in the vitreous, cornea, iris, retina and crystalline lens. This variety has been named "*Filaria Lentis*" and "*Filaria Oculi Humani*." Nordman examined two cataracts half an hour after they had been taken from an elderly man by Prof. von Graefe, in one of which he found two very small "thread worms." One of the two had been injured in the middle so that the intestines had come out of the body and were visible as slender threads. The other was uninjured, of uniform thickness,  $\frac{3}{4}$  line long ( $\frac{1}{16}$  inch), extremely narrow. It was spirally convoluted and dead. A simple intestinal canal, a mouth with visible papilla, a uterus and a prominent anal aperture could be distinguished." (Nordman, 1831, *Mic. Beiträge, z. Nat. d. Wirb. Thiere*, pp. 7, 8). In 1832 he investigated this subject still further and found the same worms in cataracts in several

instances (loc. cit.). Von Ammon has corroborated these discoveries in a case of cataract which he extracted (*Klin. Darstellung*, Vol. XII).

In a chapter on Entozoa (Norris & Oliver) by Salzman, we find a description of the variety of worms illustrated in my case of filaria loa. I quote the following: "We know but little of the natural history of the Filaria Loa. The Filaria Diurna, that by day is found in the same places in great numbers in the blood of negroes is supposed to be the embryo of the Filaria Loa. It is believed that these embryos are sucked up with the blood of the negroes by the mosquitoes, that they undergo further development in these intermediate hosts, and that they are deposited in the water with their eggs. Water contaminated in this way may cause reinfection of man." He further states, "Its acclimatization is not to be feared, since the conditions favoring its propagation are present only in a circumscribed area of its normal habitat (West Africa)."

In the March number of the *Ophthalmic Record* we find an illustrated review of an article by Ransom on "Manson's Eye Worms of Chickens." The illustrations correspond with those of the true Filaria Loa, but the worms do not live in the connective tissue as illustrated in my case report. They exist under and around the nictitating membrane in the bird, where they lie coiled, and can be extracted in great numbers. They infect the nasal passages of the fowl later on and cause death. They also cause the eye to suppurate. They are found in this country, especially in Key West, Florida.

I have the privilege of presenting the complete bibliography on the subject, compiled by Prof. Henry B. Ward, Lincoln, Nebraska, who has recently written a work on the subject which will attract widespread attention at home and abroad by all interested in Helminthology.

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## RETINAL CHANGES AS AN AID TO DIAGNOSIS IN VASCULAR DEGENERATION.

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WE have in the eye the only organ where a terminal set of vessels can be seen and where it is possible to observe by means of the ophthalmoscope changes in the retinal vessels and capillaries that enable us to detect in many cases alterations that are indicative of disease of the general vascular system. The information thus elicited is important from a clinical standpoint, in that in many instances it is the first inkling of the fact that degenerative changes are taking place elsewhere, and those seen in the eye are only part of a morbid process existing in the blood and bloodvessels of the brain, kidneys and other portions of the body.

It is not my intention in this paper to speak so much of gross lesions occurring in the background of the eye, whether of the retina, choroid or the optic nerve, as to call attention to those slight anomalies that are recognized from time to time and show themselves in alterations in the caliber and contour of the retinal vessels, sometimes so slight that they may be easily overlooked if a careful and diligent study of the background of the eye is not given.

We all know that certain abnormal conditions of the fundus depend for their existence upon pathological changes, usually of a degenerative character, going on in other organs

of the body, having for their origin a diseased condition of the blood and bloodvessels. These occur in people who are apparently in good health; nothing of a suspicious nature for one moment leads us to think that anything is wrong until an ophthalmoscopic examination is made when the patient consults the ophthalmologist for some apparently trifling symptom referable to the eye.

We are enabled by closely studying the fundus to detect very slight structural changes in the retinal vessels which lead us to form conclusions of an almost positive nature that there is a commencing degeneration of the arterial walls which are suggestive of the existence of a similar condition of affairs in the smaller arteries situated elsewhere in the body and signify an arterio-capillary fibrosis.

Tortuosity of the retinal vessels, although one of the earliest phenomena, is not in itself a positive sign unless confirmed by the presence of other variations from the normal which are generally to be found in the early stages of arterial degeneration. These are the alterations in the caliber of the vessels showing inequalities in the breadth of the vessel at various points in its course. The localized contractions in some instances amount to almost total disappearance of the capillary which then regains its normal size; this condition occurring over and over again, giving the vessels a bead-like appearance. At the same time the vascular reflex is broader and brighter and whitish stripes run along the margin of the vessel wall.

Loss of translucency, in which the arteries lose their power of transmitting light, occurs where a vein is crossed by an artery. The vein becomes obscured at this point and the phenomenon is usually accompanied by an appearance of compression and loss of the light streak in the vein on either side of the point of crossing. In the more advanced stages the vein is practically obliterated from the pressure exerted by the artery, and enlargement of the distal end of the venous current is quite apparent. On the other hand, when the vein crosses the artery it appears to hook over that vessel with less signs of compression of its coats.

Oedema of the retina from interference with its nutrition occurs sooner or later and is recognized as a grayish haze,

which is better seen in the macular region or along the course of the vessels. Hæmorrhages into the retina eventually show themselves as the disease advances. These changes occur along the course of the vessels or at isolated spots in the retina, or they may even be sub-hyaloid in character.

Microscopically these changes are found to be due to a thickening and loss of elasticity of the walls of the vessels and to a narrowing of their lumen from the formation of connective tissue, mainly in the intima. These degenerative alterations effect both the muscular and elastic tissues and eventually bring about hyaline degeneration of the entire vessel wall. The pathologic changes are never really primary in character, but are a part of a general arterio-capillary fibrosis, which has been gradually developing for a variable length of time as the result of the absorption of an endogenous poison produced by some derangement of nutrition.

The eliminating powers of the excretory organs become interfered with and the toxic elements are absorbed into the blood, producing an irritation of an infective nature. The relation of vascular disease to various morbid conditions in certain organs of the body is well known. The causes that lead up to these changes in the circulation depend upon the absorption into the blood of the toxins given off under diseased conditions existing in the general system, which, if not checked, have an effect upon the vascular coats, that ultimately result in pathological changes which sooner or later become permanent and produce degenerations in various organs of the body. They are due to the retention in the system of effete substances which act as poisons, their existence depending upon defective action of the excretory organs.

If such excretory organs as the kidneys and liver, act indifferently there is an accumulation of toxic matter which absorbed into the blood stream produces morbid changes, not only in the vessels of these organs, but more particularly in the general vascular system.

Primary arterio-sclerosis depends in great measure on just such a cause. Arterio-sclerosis in the true sense of the term is probably never of primary origin, but is secondary to a degeneration which has already existed for some length of time. The patients whose retinal vessels show these degen-

erative changes are generally those who have reached the age of forty or fifty years, who have led a sedentary life, and who are fond of good living. There is, also, a history in most instances of some form of "indigestion," and in many cases there is a distinct history of gout or "rheumatism." It is in such cases that the natural functions of the excretory organs are not carried on perfectly. A form of poisoning results from absorption into the blood of the effete matters which are insufficiently eliminated.

Gout, syphilis and alcoholism are associated very frequently with, and play an important role in the causation of these vascular degenerations. They are very likely in the majority of instances the underlying cause of the arterial disease. What effect the poisons have upon the blood and the vessel wall is not clearly understood, but these changes are probably of such a character as to cause a high blood pressure from increased resistance to the blood current in the peripheral vessels. This is followed by hypertrophy of the heart and eventually atheromatous changes in the arteries. As the disease advances in the system and a general arterio-sclerosis develops, the changes in the retinal vessels may be regarded as merely a part of those vascular alterations that are at the same time taking place elsewhere in the body. These pathologic changes may go on for years without giving rise to any untoward symptoms that have an effect upon the patient's ordinary mode of life. It is only when the disease has advanced to the stage in which foci of sclerosis appear in the kidneys, liver and the larger vessels that notice is taken of them or even a suspicion is entertained that the patient's health is effected and that his life is in danger.

There is probably no other disease in which arterio-sclerosis plays a more conspicuous part than atypical chronic gout, a disease characterized among other changes by a high arterial tension and cardiac hypertrophy. The gouty diathesis predisposes to vascular degeneration of a more or less pronounced type, the presence of which is recognized in retinal changes confined more or less (especially in the early stages) to certain alterations in the retinal vessels and circulation, although these changes do not differ materially from those which are present in the course of arterio-sclerosis due



to other causes. It is well recognized that degenerations of the retinal vessels, of the retina itself, are probably more indicative of chronic gout than any other morbid process. This is probably due to the presence of deleterious matter in the blood, which, acting on the coats of the vessels induces a high arterial tension, and is responsible for the alterations in the arterial walls themselves. These same causes bring about sclerotic metamorphoses in the smaller bloodvessels and capillaries.

The degenerative changes show themselves in the retina by alterations in the appearances of the bloodvessels which in the early stages are so slight that they are easily overlooked if a careful examination is not made. The retinal arteries are diminished in caliber with more or less tortuosity of the distal end of the vessel; the bright streak is broader and there is decided loss of translucency, so that the underlying vein at a point of crossing does not show itself through the artery but seems pressed upon almost to the point of obliteration.

As this degeneration becomes more extensive œdema of the retina, even to the extent of interference with the visual power, develops. Later on, in the more advanced stages of the sclerosis, the vessels become engorged and tortuous, and hæmorrhages take place from the degenerated capillaries.

#### PROGNOSIS.

The significance of these retinal changes and the influence they exert upon the life of the individual depend largely upon their cause and the progression of the degeneration in other portions of the body. The degenerative process which so often has an insidious beginning may have gone on for some time before any abnormalities in the ocular fundus are noticed. Not until gross lesions have shown themselves in the eye can we positively say that a fatal termination is apt to occur. The mere fact that such conditions exist in the retinal vessels, does not warrant us in assuming that the disease is going to progress to such a stage as to effect the function of the kidneys and liver or to cause degenerative changes in the brain.

The course of arterial degenerations is usually a slow one, although exhibiting periods of exacerbation. The patient's

ordinary occupation is very little interfered with. There are ordinarily no symptoms of any moment which would point to an altered state of the general health. The patient lives his daily life unconscious of the existence of these phenomena until some marked symptoms from the occurrence of retinal hæmorrhages, thrombosis of the retinal vessels, etc., show themselves and the clinical aspect of the case becomes decidedly changed. When these vascular changes are recognized and appropriate treatment is instituted early, the progress of the disease may be arrested and the patient's health remain apparently in a normal condition. An unfavorable prognosis depends upon the state of the heart and other organs. When the degeneration has so far advanced that the vascular walls are impregnated with tissues that are foreign to them and hæmorrhages into the retina and obstructions in the circulation have occurred, then an arrest of the progress of the disease cannot be hoped for. The main points I desire to bring out in this paper are embodied in the following conclusions:

1. The retinal vessels are liable to changes which are indicative of general vascular disease.

2. That these changes are readily recognized by ophthalmoscopic examination in the very early stages of the arterial degeneration.

3. When recognized early and appropriate treatment is applied, the disease can be arrested and a favorable prognosis given.

4. The principal early ophthalmoscopic signs are, (a) contraction of the arteries; (b) compression of veins where crossed by arteries; (c) loss of translucency of the arteries; (d) broadening of the reflex streak along the course of the vessels.

## THE TREATMENT OF RECENT EMBOLISM OF THE RETINAL ARTERIES BY DIGITAL MASSAGE.

By H. V. WÜRDEMANN, M.D.

MILWAUKEE.

**O**CTOBER, 1901, I reported<sup>1</sup> two cases of recent embolism of the central retinal artery, in one of which all visual functions were restored to the normal, and in the other partly cured, by deep digital massage.

Owing to the rarity of the affection, and especially the fact that cases are few in which the clot has become impacted in the vessel only a few hours or days before examination, the experience of any one observer can certainly be limited. I therefore have welcomed the opportunity of examining and treating the few cases that have applied to me, especially as the results of treatment have been uniformly successful.

For several years I awaited the arrival of a new patient with recent embolism, but saw none, although two cases of ancient embolism were examined—but of course not treated, as I believe “there is no treatment” for old cases. I have this year met and treated two additional recent cases, the histories of which are herewith detailed.

Diverse opinions upon the prognosis of retinal embolism exist. Riemar<sup>2</sup> says that in the cases of either embolism or thrombosis we must expect total blindness and granular breaking up of the blood column in the vessels concerned. In his article of June, 1899, Casey A. Wood<sup>3</sup> reports five cases of retinal embolism that came under his care. Case I had complete blindness, which partially spontaneously recovered. He asks, “What curative value would have been assigned to the use of massage, iridectomy, paracentesis cornæ, sclerotomy or eserine, if any of these forms of treatment had been resorted to in this case as soon as the blindness had been observed?” Dr. Wood is optimistic when he says that “The fact that must always be reckoned with in estimating the value of any remedial measures for retinal embolism is the tendency of almost every case to improve, with or without treatment.” Others are not so sanguine. Recent text books advise iridectomy and paracentesis, but I fail to find any

case in the literature that has been benefited by these procedures. Amyl nitrate inhalations have been suggested by Gifford.<sup>4</sup> Forceful ocular massage seems to give the best results. "Its reputation rests upon a few successful cases."<sup>5</sup>

The earliest case reported as treated by massage that I can find was by Ehrle<sup>6</sup> who, in describing 21 cases of partial and complete embolism (the percentage being 1:3000 in clinic or 1:1600 in private practice), states that *one* case received better vision after treatment by massage; in other cases iridectomy and paracentesis were done without any result.

I have collated all the cases I could find that have been treated by this method, abstracts of which are herewith presented. The cases of Mules,<sup>7</sup> Hirschberg,<sup>8</sup> Hilbert<sup>9</sup> and Fischer<sup>10</sup> are said to have been completely cured. Of Casey A. Wood<sup>11</sup> four cases treated by massage, none were cured, but these were apparently benefited by the combination of treatment. Full recovery has ensued in two of my own; the other two have been benefited.

It seems to be the general opinion that an embolism impacted in the central artery of the retina or its branches, or a thrombus formed therein, causes immediate total blindness of the area supplied by that vessel, and that in most cases this is permanent. This is certain if the clot completely plugs the vessel, thereby cutting off the nutrition of the retina, for then atrophic processes ensue. The force of the blood current certainly tends to drive the clot in tighter and to more completely cut off the circulation. We cannot expect to see a thrombus become absorbed within a few hours or days. Absorption of a blood clot, we know, is ever a matter of a week, or perhaps many weeks; or possibly it may become organized and remain as fibrous tissue. Aids to absorption may be found in those remedies which rapidly change the blood, i. e., diaphoretics, purgatives and alteratives, but none of these can effect a mechanical change in either moving the clot, breaking it up, or changing its position. Surgical procedures, such as paracentesis and iridectomy, temporarily change the intra-ocular tension, and have been recommended, but I can find no case in which the cure of retinal embolism could reasonably be ascribed to these procedures.

We can, however, sometimes move an embolus in the retinal arteries by pressing or rubbing the eyeball, even though it be in the optic nerve back of the eye. Should it be a hard clot, it may probably be tilted or turned in the lumen of the vessel, allowing some of the blood stream to pass. It may be broken up into fine enough particles to permit of it passing into the smallest vessels where the disturbance of nutrition would be very slight and absorption would more rapidly take place. The same may be said of a thrombus formed at this site, but the latter is apt to be large and soft. It will be liable to fully choke up the vessels, and no method likely to secure dislodgment or disintegration. Such cases remain permanently blind and cannot be cured by any form of treatment.

I ascribe the success of the treatment in my cases mainly to the massage, which permitted a flow of blood past the obstruction and kept up the retinal nutrition until sufficient absorption of the clot had taken place.

In support of my contention as to the curability of the affection in the early stages, I offer the following clinical reports:

CASE 1: Ehrle<sup>12</sup> in describing 21 cases of partial and complete embolism, states that one case received better vision after massage.

Fischer's<sup>13</sup> admirable monograph of 246 pages is based upon one case.

CASE 2: Total embolism in a healthy woman. Sudden and total blindness. Seen two hours after the attack; treated by lengthy massage (one-half hour and more at each sitting, apparently once a day for over a month) and K. I. Immediate improvement after first massage to perception of light. Fischer could observe the circulation return under pressure of the fingers. A scotoma remained for a month, but six weeks after the attack the vision was  $\frac{6}{6}$ , with full V. P. About four months later the patient died of an abortion.

CASE 3: Mules<sup>14</sup> had a case of partial embolism (of the inferior retinal artery) which he treated by massage, which entirely recovered function.

CASE 4: Hirschberg<sup>15</sup> reported a case of an *old* embolism of the inferior temporal retinal artery, which soon after

strong massage upon the posterior temporal side of the eyeball towards the nose, in the course of about a minute improved the vision, which in a little while became normal.

CASE 5: Hilbert<sup>16</sup> had a similar case of embolism of the inferior temporal artery which was rapidly cured by massage.

Casey A. Wood<sup>17</sup> reports the following four cases.

CASE 6: There was a partial embolism in an apparently healthy subject ( $V=20/40$ , Jaeger 1 when held above horizon, lower half of V.F. wanting). Massage (one treatment) immediately after attack by Dr. Hotz; no result; iridectomy (11th day of disease); gradual improvement in central vision ( $V=20/20$  almost, and Jaeger 1 at 14 inches) and extension of the visual field (remained hemiopic, but increased downwards and temporally).

CASE 7: There was total embolism of the left artery; organic disease of the heart; retention of a small island of percipient retina; (total blindness at first); treatment by massage (5 days) with slight improvement. ( $V$ =outlines of large objects, V.F.=an island of 2 to 3 degrees inner aspect of retina).

CASE 8: Total embolism in a healthy woman; seen second day.  $V$ =doubtful perception of light with focal illumination; immediate massage, repeated four to six times a day (5 days); iridectomy seventh day. Six months later  $V$ =fingers at 2 feet, V.F.=island of about 5 degrees around fixation point.

CASE 9: Total embolism in a patient subject to cardiac disease; preservation of partial vision by cilio-retinal vessels; treatment of small avail. Seen first day after attack,  $V=20/100$ . Jaeger 16 eccentrically, V.F.=island of about 6 to 7 degrees at central point. Immediate massage, amyl nitrate inhalations for over a week. Six weeks later  $V=2/7$ , Jaeger 14. V.F. increased to an oblong area  $5^\circ \times 15^\circ$  to temporal side of fixation point.

CASE 10: Fraenkel, Fritz,<sup>18</sup> reports a case of injury from exertion of shoving a piece of wood under a wagon wheel, causing total and sudden blindness from closure of central artery; seen thirty-three hours after onset. Treatment by pilocarpine, light massage; third day, paracentesis, atropine. Paracentesis repeated twice during a week. Cilio-retinal

vessel found to supply a section of retina alongside of optic nerve about  $1\frac{1}{2}$  times size of nerve head. (Apparently similar to my case No. 13\*) Result, 17th day,  $V=\frac{6}{60}$  and No. 13 at Jaeger at .35.

My first cases treated by massage were published October, 1901, in the *Annals of Ophthalmology*.<sup>19</sup>

CASE 11: At first total embolism following menstrual period; woman of 29; total sudden loss of sight six days before. Deep massage, pilocarpine sweats, salines, and K.I. Perception of light in 24 hours. Six days of forcible massage, twice a day; then could see small objects. Large central scotoma; V.F.= $\frac{6}{6}$ , Sn. 0.50 at .50; V.F. normal, except small paracentral scotoma. Later this disappeared and vision has remained normal.

CASE 12: Hard drinker, said to have heart trouble; physical examination negative. At first, total, subsequently, partial embolism; sudden blindness three weeks before. V=movement of hand. Massage, K. I. Restoration of circulation in superior retinal vessels, clot forced into inferior by massage. Result = hemiopic field, V. eccentric= $\frac{2}{40}$ .

Since that time I have used massage in the following two cases, which I report more in detail.

CASE 13: P. M. O., aged 40 years, a full blooded, apparently healthy man, weighing about 225 pounds, a free liver, no history or signs of syphilis, rheumatism, heart or kidney disease or diabetes; urine sp. gr. 1034. Came December 18, 1903, with a typical total embolism of the left central artery, which had come upon him the previous day at 4:30 P. M. The arteries carried no blood, the veins were full, but not very tortuous, disc very pale, the typical cherry-red spot at the macula was particularly prominent. V=faint perception of light: R.E. normal. He gave history of having had several attacks of transient, but not total, blindness in the left eye during the previous year, but each time completely recovered his vision. I massaged the eye with thumb pressure; ophthalmoscopic examination made immediately afterwards showed that some blood entered the retinal arteries and that

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\* Genth (Arch. f. Augkd., ii, 1) reports a case of similar nature resulting in atrophy of papilla, but eccentric V.  $\frac{1}{100}$  in a triangular area contiguous to temporal margin of disc extending half way to macula.

the disc became pink; sensation of light and form returned. He was sent to the hospital and digital massage given twice a day, daily pilocarpine sweats and iodide of potash, as in previous cases. Five days later, there was more improvement,  $V=6/40$ . Could read Sn. 1.00 at 0.50 (ordinary print) letter by letter if he looked slightly eccentrically. The visual field could now be taken and showed an extreme contraction. (See Fig. 1).

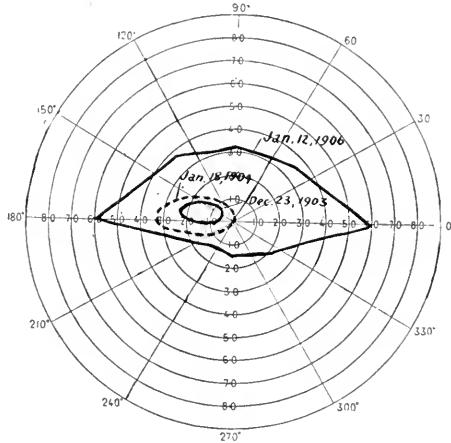


Fig. 1.

The main retinal arteries carried but little blood, and the color of the fundus was very pale, but the optic nerve head was pinkish, especially to the macular side; an irregular island, about the size of the optic disc, was of a brilliant red color, and to this proceeded two accessory arteries from the optic disc. This was the only functioning portion of the retina. This area did not change in appearance, but the portion of the visual field corresponding to it slightly enlarged, the remainder of the field being absent. Several massage treatments were given in the office with the Bilmayer vibrator. He returned home December 24th, being given idonucleoids, as his digestion was disturbed by the potassium iodide. January 18, 1904, the field was several times the size,  $V=6/40$  eccentrically as before (See Fig. 1). He was then advised that nothing could be hoped for from treatment and directed to discontinue same.

He returned January 12, 1906, having had no treatment



for one year. L.E.  $V=6/60$ . V. F. greatly enlarged above, having now a hemianopic character (see Fig. 1). The appearances had likewise undergone considerable change (see Plate II). The nerve atrophic, slightly cupped, the arteries very small and accompanied by whitish lines of considerable thickness and could be traced only two to three disc diame-



Plate I.

CASE 13. Reproduction from colored drawing of fundus, Dec. 18, 1903.

ters away from their entrance, the veins smaller and also showing sclerosis of their walls, the retina atrophic and complete disappearance of the dark colored island which proceeded from the optic disc (see Plate I).

This is a rare example of accessory retinal arteries, which being derived from the chorioid plexus, had no connection with the clot in the central artery. In this case I do not

think the treatment was of the least effect, but that the partial restoration of function was due to the anomalous arteries.

CASE 14: A. K., aged 21, farmer, consulted me September 16, 1904, stating that total blindness of the left eye had occurred suddenly six days before while at state fair. There had been some improvement of vision, and on exam-



Plate II.

CASE 13. Reproduction from colored drawing of fundus, Jan. 12, 1906.

ination the vision was  $\frac{2}{40}$  in the affected eye; the other eye full  $\frac{6}{6}$ . Visual field could not be taken, but was evidently contracted. He had hypertrophied left ventricle and mitral regurgitation. Said he had had some rheumatism and six months before had quinsy. Ophthalmoscopic examination showed typical total embolism, the optic nerve and surrounding retina being edematous, there being several small hæmor-

rhages near the courses of the main arteries; the cherry-red spot was typical. Immediately following the ophthalmoscopic examination I made forcible digital massage for about two minutes. Again examining the case with the ophthalmoscope, I found that the contracted arteries were carrying blood, that the veins were less dilated, and the patient expressed himself as seeing better. The massage was then continued for about ten minutes. Patient returned three days later, was sent to the hospital, given pilocarpine sweats, and iodide of potash internally. Hot applications were made to the eye for one-half hour on every third hour; dionin (10 per cent.) was instilled twice a day for two days. The massage was repeated in the evening, three times the next day, and twice a day for the following four days. After the massage the eye became very tender and the procedure could not be forcibly applied. A number of more hæmorrhages appeared in the fundus, but on the third day the vision was increased to  $\frac{6}{24}$ , and the visual field became larger. At no time was there any scotoma. He returned home after having ten treatments by digital massage, being in the hospital eleven days, during which time he received ten pilocarpine sweats, taking increasing doses of iodide of potash. His vision was then  $\frac{6}{7}$ . He was again seen twelve days later, when the vision was  $+$   $\frac{6}{8}$ . Several office treatments were then given by the Bilmayer vibrator. He returned to his home and continued taking the iodide of potash. Returned December 31st (three and one-half months after the first examination), which was the last time he has been seen. His vision was then  $\frac{6}{6}$ , the fundus nearly normal, and the visual field the same as when taken September 30th. He has gained 25 pounds since treatment, weighing 210 pounds.

CASE 15: O. K. R., aged 54, had right hemiplegia with motor aphasia three months ago. (Seen December 30, 1905). He noticed that the sight of the right eye became dim but recovered from time to time since the attack, but for several weeks had been blind. I was called in consultation by Dr. Noer, to his home in Stoughton, Wis., and found typical picture of total retinal embolism, general arterio-sclerosis, partial recovery from aphasia and nearly complete recovery from the hemiplegia. Diagnosis, cerebral hæmorrhage over speech

centers, probable embolus carried to eye or endarteritis of ophthalmic artery with formation of large thrombus. Massage and the other methods advised above were given for ten days or more by Dr. Noer, but given up, as the eye remained blind. I did not see the case again, and my final diagnosis of the eye lesion is endarteritis with formation of large thrombus. Hence the failure of massage in this case.

Fischer observed his own case very carefully, making ophthalmoscopic examinations during the sittings in which the massage was given. The patient bore the treatment very well and for a long time. At first sitting he gave a full half hour of massage. The next day there was some extravasation about the papilla, which he believed to be due to diapedesis. These small hæmorrhages were absorbed and had no permanent effect.

In Hirschberg's case, immediately after treatment there was irritation, pain, lachrimation and photophobia, supposed to be due to the return of function.

Barkau<sup>20</sup> forces the eyeball back into the orbit, holding it 30 seconds, then suddenly relaxing the pressure, and claims to have cured one case.

Casey A. Wood does not believe in such heroic treatment. "I do not believe that, with the majority of American patients at least, it is possible to keep up effective kneading of the globe for more than two or three minutes at a time, and it seems more rational to attempt to accomplish this two or three times daily than to continue the massage half an hour once a day." I think that Wood's patients are not treated heroically enough and that perhaps he might have had better results if he had been more persistent and forcible in the massage. While all my patients have certainly deemed the energetic massage I gave them a severe treatment, yet they have stood it well and the results have certainly warranted the procedure. No other method of treatment has ever given any such results. If partial or complete recoveries have followed iridectomy or paracentesis, such would probably have happened from a *laissez faire* policy or from the absorption treatment (K. I., pilocarpine, etc.). These eyes are doomed to blindness unless we can immediately dislodge the clot or break it up sufficiently to allow enough blood to

pass through the vessel to give nutrition to the retina. No damage has been done by massage in this connection, and even if such be possible, the procedure can be borne by the patient with sufficient grace to warrant its application.

I apply the following method: After instillation of two drops of 5 per cent. cocaine or 1 per cent. holocaine solution, a little vaseline is put into the eye, the operator stands in front of the patient who is in a sitting or lying position; one hand is placed back of the patient's neck to steady the head, and the thumb of the other pressed deeply between the eyeball and the wall of the orbit, the lids being closed, almost dislocating or gouging out the eye. Then with a slow, rotary motion the thumb is passed round the eyeball, the pressure being suddenly released and then repeated. This procedure is kept up for five to ten minutes—until the patient can stand the pressure no longer and calls for its stoppage. The treatment is made three times a day at first, then twice, and then once daily. The largest number of such treatments was given in my last case, being ten in six days. In three of the cases half a dozen office treatments were given by the electric vibrator once a day, after digital massage had been stopped. I have recently been using suction vibrator attached to the Pyncheon pump on the Victor electric apparatus, for the purpose of increasing the blood supply to the optic nerve and retina in cases of atrophy, and believe such would be applicable to the treatment of embolism and thrombosis.

All these patient's had hot compresses one-half hour on every third hour during the day for the first week, from four to eight pilocarpine sweats, and large doses of the iodide of potash for several weeks, medication by iodides being continued for a month or more in smaller dosage. After the third or fourth treatment the eyeballs become tender to touch and cannot be so forcibly rubbed, but in no case has any inflammation been produced nor has dislocation of the lens or retina followed. Even if such an accident should occur, the risk is well worth the taking, as these cases are otherwise hopeless.

I, therefore, strongly recommend forcible, deep, digital massage as the main hope of relief for recent retinal embolism.

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## DISCUSSION ON

## RETINAL CHANGES AS AN AID TO DIAGNOSIS IN VASCULAR DEGENERATION,

BY THOMAS A. WOODRUFF, M.D.

AND

## THE TREATMENT OF RECENT EMBOLISM OF THE RETINAL ARTERIES BY DIGITAL MASSAGE,

BY H. V. WURDEMAN, M.D.

DR. CASEY WOOD (Chicago): I would like to say something about both these papers. I think the paper of Dr. Woodruff ought to interest all of us. I have felt that we have not done our duty to the profession in general in that we have not taken full advantage of the fact that we see in the back part of the eye as nowhere else the bloodvessels and the minute changes going on. I do not think we have advanced in five years in determining from these visible vessels, and in assisting the general practitioner in, the diagnosis of systemic disturbances, and I think there is a large field there and much to be done. I think it is the duty of every man who is able to associate a definite change with some well-defined systemic condition, to publish such cases, and in the course of time we may be able to form decided opinions as to what is taking place from the mere appearance of the fundus alone. Coming to the matter of the crossing

of an artery by a vein, it might be further studied. I have not so definitely decided as he upon the value of prognosis and diagnosis from the changes that occur and the relative conditions of the vessels at that point; but I have investigated some cases in consultation with Dr. Woodruff, and the condition he has outlined certainly does appear. I think we need a very large number of observations and they ought to be made definite without these references to sclerotic changes and other indefinite terms. We should give up being ophthalmologists alone and should study general pathology and determine as definitely as possible what are the changes of the minute vessels throughout the body. We will find that they correspond very closely to the changes in the eye, and I believe it is well worthy of our study. I believe also that in the rush of private practice and clinical examinations we do not examine the fundus with the ophthalmoscope, especially the periphery, with the care that we might, always being on the look-out for these very minute changes. The gross lesions are, of course, important, but the most minute changes we can see are the ones which are the most important of all from the standpoint of the general practitioner.

DR. E. E. BLAAUW (Buffalo): I should like to say a few words on the last paper in regard to the question of embolism. I do not doubt the diagnostic experience of Dr. Würdemann, but I do doubt his conclusions. I doubt if these cases were embolism. These things can only be diagnosticated with the microscope, and in all these cases that have been examined the condition found was an arterio-sclerosis of the vessels of the optic nerve. The most elaborate paper on this subject is in the last edition of Graefe's Archiv., 61 Bd. For arterio-sclerosis speaks the intermittency mentioned by Dr. Würdemann, the absence of valvular lesions, the onset after f. i., and the loss of blood as in one case of Dr. Würdemann. In true embolism we can do nothing; these cases are very rare. The oculist sees the changes of the vessels around the disc, and the most pronounced at the disc. They are not so marked in the periphery. The older the patient is the better the prognosis. I have seen a case of 77, of so-called retinitis hæmorrhagica, and the patient is living two years later.

DR. KNAPP (New York): I have seen a moderate number of these cases, in which the changes were all around the macular region, which was free, and they are not so very rare. I have also seen a number of cases where the macular vessels were impervious, blocking the macular region, and then their area is gray, at times with hæmorrhages, especially at the border. [Dr. Knapp illustrated with chalk the two kinds of cases.] Total embolism, I have never seen cured. There may have been some cases reported, but they are rare, and the disease is not. I have used pressure, but not in the manner of the lecturer, but gradually and gently. I think it not wise to do it forcibly. Endarteriitis is the chief cause of this blocking of the arteries, and not embolism. The same process is seen oftener in the brain than in the eye, and I remember a few cases which were remarkable. One case referred to a high liver. He recovered and has not had a recurrence in these thirty years. I warned him when I saw his optic disc. His physician thought my fears were exaggerated, but in the second week he had hemiplegia. Another case was that of a lady, whom I saw a few months ago, who also had a hemiplegia, which was not so pronounced, and by dieting and watching her for about six weeks she was greatly improved, and got well later on.

These cases are not entirely incurable, and I think that the oculist has a large field before him to do an immense amount of good, chiefly in preventing this awful affliction. He now-a-days sees many of these patients in the initial stage of the arterio-sclerosis. The treatment is strict hygiene. Overeating is mostly the cause, then alcohol, and also to a certain degree nicotine. Daily, regular exercise is a necessity. The wealthy town people may take a half hour's chamber gymnastics after their bath in the morning before breakfast. Several treatises on diet and exercise are in the market; a very commendable one is by an English physician and has the title, "Diet in Relation to Age and Activity," by Dr. Thompson.

DR. WÜRDEMANN (closing discussion): Pathologically speaking, I think the criticism may be well made as to whether those cases are true embolisms, primary or secondary, or endarteriitis. Therapeutically speaking, it matters



not what they are. They present the clinical picture as we know it from experience of the so-called embolism, and if we can dislodge this clot, whether from the heart or secondary, then we are doing some good in the only possible way by mechanical treatment. In several cases similar to the one reported by Dr. Knapp, I have seen it followed by endarteriitis, and there has been scotoma, and a blind spot in the field. It has been my fortune to have a section of an eye in which I found a clot in a central vessel. The case was one of thrombosis of the central vein with secondary formation of a clot in the arteries. I have the microscopic specimen in my laboratory. It was a case following mumps. Two weeks ago I saw a case of similar character, but in the first case the circulation was so arrested that secondary glaucoma set in and the eye was lost.

With reference to Dr. Woodruff's paper, I have seen the lymphagogic action of dionin of great therapeutic value in inducing the absorption of retinal hæmorrhages. I saw two cases get their sight back, and I believe it was due to this. I believe in this case massage would do more harm than good. But where the thrombus forms in the vessel and is carried through, I believe massage is of great benefit.

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## SPONTANEOUS HÆMORRHAGE INTO THE VITREOUS.

By THEODORE SCHNEIDEMAN, A.M., M.D.

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**H**ÆMORRHAGES into the vitreous humor are common enough. In the majority of such instances the bleeding is the result of a traumatism, so that in the presence of such cases the probabilities are always strong that the eye has been subject to external force. In fact, in some of the cases reported as instances of spontaneous hæmorrhage, a trivial injury is recorded as having preceeded the bleeding.

Another class of cases occur as the direct result of gross disease of certain of the ocular structures such as hæmorrhagic glaucoma, thrombosis of the central vein of the retina, choroiditis, retinitis, etc. Another group depends upon dis-

turbances of the general circulation such as those accompanying menstrual anomalies, hæmorrhoids, etc.; while others have been found in diabetes and renal affections as well as in pregnancy.

The class of cases intended in this communication do not refer to any of the above divisions, but to those which may be truly called spontaneous, in the sense that no causative condition of the eye or general system can be found.

Of constitutional diseases, tuberculosis, pernicious anæmia, syphilis, malaria, are such as cause changes in the vessel walls, rendering them brittle. In such cases Friedenwald and Fehr have shown disease of the retinal veins. Friedenwald has observed perivasculitis with the ophthalmoscope, while Fehr has seen with the microscope that the retinal vessels are thickened, narrowed in portions through hyaline degeneration, and even entirely blocked. Certain observers consider hereditary syphilis as the causative condition, a view which is strengthened by the fact that interstitial keratitis has been found in some cases.

These hæmorrhages are frequently not limited to a single occurrence, but recurrences are the rule. The subjects affected are generally young persons from the age of 15 to 20. In many of the reported cases both eyes were involved, but this is not invariable. Frequently, as in the two cases to be reported, no change whatever can be demonstrated in the organism as a whole or in the eye. The individual affected may present the appearance of rugged health. These spontaneous hæmorrhages are rare enough to warrant the suspicion in a given case that the eye has been subject to an injury. Careful investigation must always be made before the case in question can be allowed to be one of spontaneous or idiopathic hæmorrhage.

In these cases of hæmorrhage into the vitreous, it has been supposed by some that the source of the blood is different in different cases. In the one case the retinal vessels, in the other the ciliary, are the source of the hæmorrhage. Hæmorrhage from a ciliary vessel is supposed to be productive of more serious results than from a retinal vessel.

The prognosis depends upon the amount of blood effused and upon the question of relapses. The latter frequently

take place; in fact are the rule so that the affection has by some been termed recurring hæmorrhage into the vitreous. As a rule the prognosis must be set down as unfavorable. If both eyes are affected it becomes a question as to the retention of useful vision. Detachment and atrophy of the retina with disorganization of the vitreous may be the final outcome.

The treatment of spontaneous and recurrent hæmorrhage into the vitreous is generally quite unsatisfactory. Fromaget<sup>1</sup> has had some success with the hypodermic injection of gelatine. In one case the result was remarkable. The patient had been blind in both eyes; after six injections he recovered good vision. Two years later both eyes were in good condition. Darier<sup>2</sup> thinks he has seen results from the application of radium. A gramme of the salt was applied to the eye and another to the external lateral portion of the orbit, the whole being kept in position 24 hours by a bandage.

Mrs. A. D., aged 47, noticed to her dismay upon wakening one morning that she was unable to see with her left eye. She was very sure that the difficulty, whatever it was, had come on since retiring the night before. She at once consulted her family physician, Dr. Louis Jurist, who referred her to me; so that I saw her the forenoon of the day upon which she made the discovery of ocular trouble, May 27, 1905. Examination of the eye showed that the vision was reduced to light projection. The fundus reflex was abolished; masses with a reddish tinge could be recognized in the vitreous; in fact it was possible to see some of these by oblique illumination. During the three months that have elapsed, the changes objectively observable have been but slight. There has been some return of a faint reflex at the upper and inner periphery, but no details of the fundus can be seen. Corresponding to this region of clearing there is some improvement of the vision in the opposite portion of the field where fingers can be counted, etc.

What was the cause of this extensive hæmorrhage which so suddenly destroyed the function of the eye? I have been unable to determine it. The patient has had no organic disease, although she seems anæmic. She had been living under considerable mental strain for some time. There is a

curious circumstance connected or perhaps coincident with the case. The day preceding the discovery, the woman had had a tooth extracted which she was inclined to bring into connection with the sudden loss of sight in the eye. I learned from the dentist who extracted the tooth that there was nothing unusual about the operation. Nevertheless, I can not avoid the suspicion that this traumatism may have been the last straw which determined the rupture of a vessel which had been the seat of antecedent pathological changes.

Case 2nd. Young man aged 21, complained of the sudden appearance, June 6, 1905, of a cloud before the left eye. This cloud was a fixed obscuration, constituting in fact a positive scotoma. Everything "looked red." I had examined and refracted this patient eight months before, when the vision was full, the media clear, and the fundus normal. The refraction is low hypermetropia with low astigmatism. Examination now showed that the vitreous was quite cloudy, preventing a view of the details of the fundus, although a faint reflex was everywhere visible throughout the pupil. The opacity of the vitreous cleared up rather rapidly, so that at the end of a few weeks the media had become quite clear, while two separate hæmorrhagic regions were visible in the retina; the larger one seemed directly connected with a vessel above the macular region, while the smaller was about a disc diameter from this region toward the disc. These hæmorrhages have persisted; in fact, the larger one seemed to increase and again diminish.

In this case, too, nothing could be discovered in the general condition or the ocular structures to account for the bleeding. The young man appears to be healthy. As is commonly the case, patients seeking for some cause to which to attribute their illness, he tells of wrestling with a companion, but closer questioning does not connect this event with the discovery of the impaired vision.

<sup>1</sup>Fromaget, Treatment of Recurrent Hæmorrhages of the Vitreous by Injections of Gelatine Serum, *Ann. d'ocul.*, cxx, p. 165.

<sup>2</sup>Darier, Analgesic Action of Radium and of the Radio-Active Substances, *The Ophthalmoscope*, June, 1905.

## CASES OF HÆMORRHAGE FROM THE EYE.

BY ALVIN A. HUBBELL, M.D., Ph.D.

BUFFALO, N. Y.

EXTERNAL hæmorrhage from the eye, or its appendages, is so unusual that I deem the following cases worthy of placing on record.

CASE I. *Hæmorrhage from the conjunctiva:*

A few years ago a child was born in the Buffalo Woman's Hospital, in the service of Dr. C. C. Frederick. To protect the child from ophthalmia neonatorum, the doctor ordered a single instillation of a two per cent. solution of nitrate of silver, and afterwards a weaker solution of the same—one-half grain to the ounce—in both eyes every four hours. The nurse misunderstanding the directions, instilled the two per cent. solution regularly every four hours. Within twenty-four hours the conjunctiva and eyelids were very much swollen and considerable pus was discharged. Believing that it was a case of ophthalmia neonatorum, the supposed weaker, although in reality the stronger, solution of nitrate of silver was continued. At the end of thirty-six hours, both eyes began to bleed. Dressing after dressing became saturated with blood, and soon the attendants became alarmed. I was called to the case, and found blood oozing continuously from the swollen conjunctiva. The lids were also much swollen, and on exposing the eyeballs with a small lid retractor, both corneæ were found to be quite opaque, the opacity being most dense at the lower portions. There was no ulceration or abrasion of either cornea.

I at once ordered all local "drops" to be discontinued, and the application of iced cloths over the eyes, limiting the area and effect as much as possible to the affected parts. These were kept on constantly for several hours, and cleanliness was secured by gently irrigating the lids and conjunctiva with boric acid solution. To-day I would use adrenaline solution, but the virtues of this drug were not known then. The hæmorrhage gradually lessened, but did not entirely cease until about twelve hours after the cold applications were begun. The child by this time was pale and much weakened. Recovery, however, was rapid. The swelling and

inflammation gradually subsided, and the child soon regained its strength. Both corneæ remained more or less opaque, while the patient remained in the hospital, but I was afterwards informed that the child had useful vision.

CASE II. *Hæmorrhage from the eyeball:*

Rev. J. H. H., aged 65, began to have trouble with his left eye in November, 1903, complaining, at first, of sudden loss of vision. He consulted Dr. J. H. Sackrider of East Randolph, N. Y., who, with the ophthalmoscope, made a diagnosis of "hæmorrhagic retinitis." In January, 1904, the eye became inflamed and very painful, and the sight was entirely destroyed. The use of anodynes and fomentations gave relief after a few days, and the eye was comfortable for a long time, but sight was never regained.

In the spring of 1905, the eye again became inflamed and painful. The patient was then treated by Dr. O. C. Shaw of Cassadaga, N. Y., but with only temporary relief. On June 3rd, 1905, during a severe attack, and to quote the language of the patient, "something dropped from the eye into my hand, about the size of a pea, and clear like gelatine. My wife took it out of my hand with a piece of paper and crushed it." This substance, undoubtedly, was the crystalline lens, and the incident shows that there was ulceration and perforation of the cornea. Immediately blood began to flow from the eye. "Dr. Shaw was close at hand," says the patient, "and came while the eye was bleeding. It must have bled several minutes. More than a pint of blood flowed out, and the pain was intense." Dr. Shaw administered remedies to stop the hæmorrhage, but it continued till the patient fainted. Dr. Shaw tells me that the quantity of blood may not have been a pint, but it was very large. That a large amount of blood was lost is evident, both from the statements of the patient and the physician, and from the fact that the patient fainted, and that he was afterwards so much weakened. The doctor did not determine the exact point of bleeding, but said that it was from the anterior portion of the ball.

I saw the patient at my office on June 5th, 1905, two days after the hæmorrhage took place. He was then pale and weak, and the eye was red and tender. Projecting from

the center of the cornea was a small, flattened mass of disintegrating fibrin and vitreous humor. Under cocaine anæsthesia, I excised this with scissors, when I found a perforation of the center of the cornea about five millimetres in diameter. The remaining portions of the cornea were opaque. I applied pure carbolic acid to the area of perforation, and advised Dr. Shaw to repeat it twice or three times a week till healing was well under way, and to have the eye irrigated three or four times a day with a saturated solution of boracic acid.

I have seen the patient recently and find that the perforation has entirely healed, the cornea is opaque and shrunken, and the eyeball has become somewhat atrophied.

This case was, probably, glaucoma at the beginning, with, perhaps, retinal hæmorrhages. Subsequently the cornea became ulcerated and perforated, the walls of the choroidal vessels gave way as soon as the tension was removed by the perforation, and with the choroidal hæmorrhage the lens and more or less of the vitreous humor were forced out. That a choroidal hæmorrhage should thus find external vent, and should continue so long and so profusely is unexplainable by me, and so far as I know it is a very unusual, if not unique, occurrence.

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## DISCUSSION ON

### SPONTANEOUS HÆMORRHAGE INTO THE VITREOUS,

BY THEODORE SCHNEIDEMAN, M.D.

AND

### CASES OF HÆMORRHAGE FROM THE EYE,

BY ALVIN A. HUBBELL, M.D., PH.D.

DR. DAYTON (Lincoln, Neb.): I came in late and did not have the pleasure of hearing Dr. Schneideman's paper; but speaking in a general way, it has been my lot to find but few true hæmorrhages into the vitreous. We find a great many sub-retinal hæmorrhages where the blood does not enter into the posterior chamber proper; and these hæmorrhages that enter into the vitreous chamber, in my opinion and also in the opinion of others that I have noted, have a tendency to come more from the anterior retinal vessels. Recently my attention has been called to a case of retinitis

albuminurica occurring in rather a young person where there was an excessive hæmorrhage into the vitreous, about the macular region. The peripheral portion of the retina could be distinctly seen but nothing in the macular region.

I have had several instances of injuries by missiles, clods of dirt, etc., striking the eye, and in one case by a tennis racket, which provoked a hæmorrhage into the vitreous. In young people we would naturally not expect a case occurring due to an arterio-sclerosis; this is different in older people. I saw the case of a very aged person who had been suffering from grip, with violent paroxysms of coughing and who was suddenly stricken blind from a vitreous hæmorrhage in one eye. Two or three days after that the patient's doctor informed me by the phone that the patient had also gone blind in the other eye. About a week after that I was called to see her again; and she had a general panophthalmitis in both eyes. She died about ten days after that. Here was a case in which there followed a total destruction of the eye from hæmorrhage into the vitreous. This, of course, is the very worst that may happen in those cases. Ordinarily the clot is absorbed or leaves flocculi floating in the vitreous as a sequel of a hæmorrhage. A number of years ago I saw a young girl who was struck in the eye with a clod of dirt and had an extensive hæmorrhage into the vitreous and the eye became so painful from the effects of it that sympathetic irritation followed and we were obliged to remove the eye.

True hæmorrhage into the vitreous is quite rare, when the many injuries that the eyes are subject to are taken into consideration. Especially is this true in young people. We would expect to find a greater tendency to hæmorrhage into the vitreous in people of maturer years, occurring during some organic disease or structural change in the walls of retinal bloodvessels.

DR. F. PARK LEWIS (Buffalo): Hæmorrhages into the vitreous may be due to one of two causes; first, local degenerative changes in the retinal vessels permitting rupture under normal pressure; second, some irritative condition of sufficient intensity to cause normal vessels to break. I have seen cases due to both conditions. The latter is often produced by eyestrain from some refractive error or muscular imbal-



ance. In several cases otherwise without adequate explanation, I have seen pulmonary tuberculosis develop later, and have sought to determine whether there might not be an eye-strain which so lowered the general resistance as to make the patient vulnerable to the tubercular germ.

DR. PERCY FRIDENBERG (New York): I did not hear the paper and I may be repeating something already alluded to, and that is the recurrences of intraocular hæmorrhages in conditions of menstrual disturbances. I saw some years ago an interesting case of this sort in which before it came on there was no evidence of intraocular disease. Dr. Lewis has called attention to two conditions, either local or systemic, which cause the vessels to give way. Here a girl arrived at the period of first menstruation without any symptom of local disease, and after the hæmorrhage her blood and renal and heart conditions were found to be normal. The first menstruation was scanty, and these hæmorrhages occurred and recurred at each period, and would partly clear up between times, but finally became so profuse that they would not clear up and the retina was detached. This took place in both eyes. I have colored drawings of this case, which I presented in Washington some years ago. I found that others had been reported, but the difference was that the patients were women at the menopause and who had recurrent hæmorrhages into the vitreous. Others have shown that these conditions are not limited to females. In young males there is a similar tendency and a menstrual wave. That is, there is a variation of arterial pressure to a certain extent resembling that of the menstrual changes, and a disposition to intro-ocular hæmorrhage in young boys at the time of puberty.

In reference to Dr. Hubbell's paper, with regard to hæmorrhages of the eye in the new-born, I had a case in which I could find no cause. There was no history of traumatism; the delivery was not instrumental, and the child was perfectly well. The symptoms got better under pressure bandage, and in about a week there was no clot. In another week there was the same condition in the other eye, and then again in the first, and then hæmorrhages and relapses, and this was followed by other symptoms of infantile scurvy (Barlow's

disease). The ocular hæmorrhages were symptomatic of this affection.

DR. BERNSTEIN (Kalamazoo): I should like to call your attention to a case in a boy of 14, which had been thought to be due to excessive masturbation. This case was reported to the *Annals of Ophthalmology*, with illustrations, showing the fibrous changes which eventually occurred in the vitreous, as a result of repeated hæmorrhages. Eventually the whole vitreous was a mass of fibrous bands.

DR. HUBBELL (Buffalo): I would like to speak on the subject of intra-ocular hæmorrhage. Out of a pretty large number of patients, I can recall at this time five cases of recurrent hæmorrhage in the vitreous humor, four of which were men, two of these being 22 or 23 years old, and two were in middle life. The fifth case was a woman about 65 years of age. In every case the hæmorrhage recurred at irregular intervals and would, as a rule, become absorbed without leaving any great disturbance of vision. On one occasion, however, the hæmorrhage in the left eye of one of the young men was large and the vision remained impaired. As to the causation, I have no explanation. In one case there was a doubtful history of syphilis, but in the others I have no theory as to the cause of the hæmorrhages. As to the sequelæ, they were very interesting to me. One young man had cataract, and I was told that Dr. F. Park Lewis operated on him. I do not know how much vision was left. The other young man is still under my observation. In this case retinitis proliferans has developed in both eyes. The blood has entirely absorbed in the right eye, but in the left vitreous there are numerous floating opacities and the vision is poor. I feel that we know very little about the causation of recurrent hæmorrhages into the vitreous humor, or what they will lead to.

DR. GEORGE M. GOULD (Philadelphia): I wish to emphasize the fact that eyestrain is the cause of the condition in many of these cases. This has been demonstrated in several instances in my own practice, and Dr. Lewis has found them in his. Some years ago I reported a case of subconjunctival hæmorrhage in a man of 50. For several years these hæmorrhages had occurred in either or both eyes, and

frequently the entire visible space between the conjunctiva and sclerotic suddenly filled with blood, and without discoverable cause. This gave the man no particular physical discomfort, but it produced a hideous appearance and his friends began thinking him a dissipated man. He had been treated by many of our best oculists, but their diagnosis was uniformly gout. They could find no error of refraction, because no mydriatic had been used. I corrected O. 25 D. of myopic astigmatism and there has been no hæmorrhages for ten years. Although his eyes had been pronounced "mathematically perfect," eyestrain was the cause of his hæmorrhages. The condition of the capillaries which rendered them so unresistant may have been due to gout or to other things, but the precipitating cause was eyestrain.

Suggested by Dr. Hubbell's report of a case of bleeding from the conjunctiva, I wonder in how many children we have caused blindness by nitrate of silver. Years ago I know I was guilty of using too strong solutions of this preparation. In my first year of practice, relying on what I had been taught, I had many instances of such hæmorrhages caused by using 10-grain or 20-grain solutions. Not only were the capillaries corroded, but corneæ were rendered opaque. I have found that frequent washing out of the sulci with weak astringent and antiseptic solutions is as effective as the strong silver applications. It occurred to me that in Dr. Hubbell's case the hæmorrhage was due to the nitrate of silver. If so, it supplies the caution that we should at least use the weaker solutions.

DR. YOUNG (Burlington, Iowa): I have seen a case of vitreous hæmorrhage in the past month, in a young man of 30, married, of good habits, who has for years had chronic albuminuria. This case was subsequently seen by Dr. Hotz of Chicago, referred by Dr. Billings because of the fact that I drew a connection between the hæmorrhage and the albuminuria. The patient was assured by Dr. Billings that there were no vessel changes as a result of his long course of albuminuria. The hæmorrhage was in the macular region, deep down, and an examination of the periphery of the fundus, both on the temporal and nasal side, discovered white patches and characteristic hæmorrhages. I have been unable to see

why one should not account for the vitreous hæmorrhage as a result of the albuminuric process.

I have also seen a case of extensive subconjunctival hæmorrhage in a man of 50, so extensive that the conjunctiva almost projected between the lids.

Twenty-six years ago I saw a case of recurrent hæmorrhage into the areolar tissue of the lids; complete ecchymosis of the lids, apparently, without injury. This was in a clerk in a drygoods store. On change of occupation the hæmorrhages ceased. He looked as though he had been in a fight, both eyes blackened, the skin of the lid as black as his hat.

Dr. Gould has brought up the subject of putting out the eyes of children in trying to prevent ophthalmia neonatorum. Since reading an article published in Alt's journal last year, I have come to believe that whatever accident has happened has been from doing Crédé *not* as Crédé described it. Over 30,000, as shown in this report, have shown no accident where Crédé's method has been followed. So many do not use it as he uses it. So when we say we do not get good results, it is because we do not use the method as directed.

DR. L. A. W. ALLEMAN (Brooklyn, N. Y.): I have seen a case relieved by a proper correction of errors of refraction. As to the effects produced by nitrate of silver, I think if you will use a solution made from the fused stick you will not have trouble. In a solution made from the crystals there is a certain amount of free acid, which is irritating. Since using solutions made from fused silver, I have had no undue reaction following the use of even comparatively strong solutions of silver nitrate.

DR. A. ALT (St. Louis): With regard to the hæmorrhage of infants after the use of nitrate of silver according to Crédé's method, there was a case in St. Louis, in which Crédé's method was used correctly, by dropping from a glass rod one drop of a 2 per cent. solution of nitrate of silver on the cornea, not into the conjunctival sac, and a few hours afterwards there was an oozing of blood from the conjunctiva, which no treatment could stop, and in spite of using even pure adrenaline—which I, however, have never seen to stop a hæmorrhage—the bleeding kept on until the child died in a week from exhaustion. I do not believe one drop

of nitrate of silver could have done that. The child may have been a bleeder. Such things can happen, I think. Similar cases have been reported by others. However, if you are afraid of using the nitrate of silver, protargol or argyrol, even in very weak solutions, seem to act as well as silver nitrate. By far, not all the cases which have been reported as having been treated by Cr  d  's method, have in reality been so treated correctly.

DR. EUGENE N. S. RINGEBERG (Lockport, N.Y.): I have seen a few cases, and I do not think the nitrate, unless strong, has very much effect.

DR. WEEKS (New York): I want to add my testimony also to the bad effect of the nitrate of silver in some cases. I saw one case in which the h  morrhage was very profuse after the use of 2 per cent. solution of the nitrate of silver, but it did not last more than twelve hours. In my opinion, if the nitrate of silver is used as Cr  d   directs, by the surgeon or by the attending physician—one drop put into the eye from the end of a glass rod—the danger is very slight, but if left to the attendant, more than one drop is usually put in, and there is danger of undue reaction. The preparations of silver known as protargol and argyrol used after the Cr  d   method, in the strength solution of 10 per cent. and 35 per cent. respectively, are not harmful to the patient, and are as sufficient as is the nitrate of silver.

DR. SCHNEIDEMAN (closing discussion of his paper): In looking over some of the reports that have been published, I have been struck by the readiness of the reporter to ascribe the condition to syphilis without other evidence, past or present, that the patient had suffered from that disease.

I recall one case, not indeed of spontaneous h  morrhage into the vitreous, but where this condition was due to a traumatism, in which the blood became organized into a membrane. There was no fundus reflex and the sight was entirely gone. Dr. Jackson operated upon this patient at the Philadelphia Polyclinic, dividing the membrane back of the lens through the sclera with a knife. The man recovered and retained a very fair degree of sight. The vitreous contained some opacities, but from no vision there was useful vision up to the time of his death ten or twelve years later.

## REPORT OF A CASE OF ELECTRIC OPHTHALMIA.

By EDWARD B. HECKEL, M.D.

PITTSBURG.

VISUAL disturbances resulting from over-stimulation, or exhaustion of the retina as a result of prolonged exposure, are sufficiently rare to warrant the presentation of the following case. Unfortunately I did not see this patient during the acute stage, but obtained the following history which is sufficiently interesting.

The patient, age 28, an electrical engineer in one of our neighboring towns, presented himself on March 10, 1905, with the following history: On December 31, 1904, he was engaged in burning out a plugged twyer in a blast furnace. A twyer is a tube through which air is forced into a blast furnace. At times there is a choking of the furnace with some solid material which suddenly drops and splashes the molten metal into one of these openings and thus plugs it. The method of removing this obstacle is to connect the positive end of a charged wire to the plug and then hold the negative end in front of it, and thus establish an electric arc which melts and burns out the iron plug. He used a current of 400 ampères and consumed four hours in burning out the plug. In other words his eyes were exposed to this intense arc-light produced by 400 ampères for four hours, during which time he had his eyes protected by a pair of cobalt glasses.

Soon after the exposure the eyes became very painful, the conjunctiva red and swollen, and a general erythema of the lids and surrounding skin appeared, which peeled off not unlike after a sun-burn. These severe symptoms disappeared within a few days, and then he noticed a large central scotoma which gradually contracted so that when he presented himself to me it was about an inch in diameter at a distance of 20 feet or more and scarcely noticeable at a working distance, so small that I failed to obtain it with the perimeter. His vision at this time (March 10) with the right eye was  $\frac{20}{20}$ , and with the left eye  $\frac{20}{40}$ . The eyes at this time presented a perfectly normal appearance; the ophthalmoscope showed both fundi to be quite normal. At this time he was ordered

to take  $\frac{1}{15}$  grain of strychn. sulph. three times daily and asked to refrain from close work as much as possible. He reported on March 22 as having improved quite a little. His vision at this time, with the right eye was  $\frac{20}{20}$  and the left eye  $\frac{20}{30}$  minus. He was asked to continue the strychn. sulph., and reported April 26, when the vision of the right eye was  $\frac{20}{20}$  and the left eye  $\frac{20}{20}$  minus and no scotoma.

Strychn. sulph. was given upon general principles; the same recovery might have taken place without anything. The most interesting feature in this case is to explain the pathological changes. I believe it to be a retinal exhaustion of those chemical elements necessary for vision; and that in addition to these there may have been some changes in the anterior layers of the retina which prevented the light from passing through to the light-perceiving stratum of rods and cones.

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## ADVANTAGES AND DISADVANTAGES OF GLASSES IN RAILWAY SERVICE:

APPENDED REPORT OF THE OPINION OF OPHTHALMOLOGISTS  
THROUGHOUT THE UNITED STATES AS TO THE SAFETY  
OF AN EMPLOYEE REQUIRING THEIR USE.

By NELSON MILES BLACK, M.D.

MILWAUKEE, WIS.

THE question of enginemen and firemen wearing glasses while operating limited trains, was very forcibly brought to my attention by a committee of the advisory board of the Brotherhood of Locomotive Engineers, asking for an opinion as to the safeness of an employee who had been many years an engineman, and who on re-examination for vision had failed to come up to the required standard. With glasses his vision was brought up to this standard, there being no ocular disease.

From an experience of riding considerably over six thousand miles in the cabs of engines, in all kinds of weather and at all times of the day and night, the following opinion was unhesitatingly given:

"It is my professional opinion that a railroad employee (engineman or fireman) who has been in continued service for a period of not less than five years and who on re-exam-

ination falls below the required standard of vision, and such vision can be brought up to said required standard with glasses, his color perception meeting the required standard and there being no ocular disease, *is a safe employee.*

“Such employee should be required to carry at least one extra pair of glasses.

“Such employee should be re-examined semi-annually to ascertain if there has been a further decrease in vision and if the glasses fully correct the visual defect.”

It is a well known fact that men entering into railway service at from eighteen to twenty-five years of age may possess from 1-4 D. of latent hypermetropia and considerable astigmatism, and be able to pass the required examinations, as they are now conducted, with ease, the muscle of accommodation being able to overcome the latent refractive error. These men on coming up for re-examination five, ten and fifteen years later will be unable to meet the required standard of vision because of a reduction in accommodative power with increasing years. They are at their most useful time of life in all other respects, their experience resulting from long years of training and the caution acquired with advancing years, more than compensates for the loss in vision, and when it can be brought up to the standard required with glasses, renders them far more useful and safe men than those with perfect eyesight and less experience.

With the vision of these men raised to the required standard and protected from wind, dust, mist, snow and sleet by glasses, it stands to reason they are safe men, safer in fact than the man with standard vision, less experience and unprotected eyes.

The objections raised to enginemmen wearing glasses are not many, but on first thought may seem serious.

1st, Becoming smeared and dirty.

2nd, Becoming covered with fog, mist, rain or snow.

3rd, Becoming fogged on coming from cold into warmth.

4th, The danger of glasses being broken.

5th, “That glasses which give a visual acuity of  $\frac{20}{20}$  in the examining room do not give an equivalent visual acuity of  $\frac{20}{20}$  when used at very long ranges, particularly under certain climatic conditions.”



6th, The legal aspect in case of accident.

1st. As to the glasses becoming smeared, there is no doubt they do become very dirty. Those of you who wear glasses should try the experiment of smearing your glasses or moistening them and let them become covered with dust and see what effect it has on objects  $\frac{1}{4}$  to 1 mile distant. It does interfere with vision for reading or viewing any object within 18 inches distance, but the signals must be observed at a distance of from 100 feet to  $1\frac{1}{2}$  miles. The same fact applies in looking through a very dirty window; objects near at hand are indistinct, but the view of those a long distance away is hardly interfered with. The principle is that of looking through a pin-hole disc—one can see distant objects distinctly but near objects can not be made out. The dirt on glasses is not evenly distributed over their surfaces; innumerable small areas are clear, and through these small areas, as with the pin-hole disc, a large field at long distance is observed.

2nd. Practically the same may be said regarding the glasses becoming covered with fog, mist, rain or snow; through the small areas not covered with the moisture one can see distinctly as far as the atmospheric conditions will permit with the unprotected eye, if not farther. Dr. Wm. Cheatham speaks of using soap to prevent lenses fogging the same as we use on laryngeal mirrors to prevent its occurrence. H. H. Seabrook refers to the use of the "lamin" pencil to prevent fogging and also as a water-proof. With these substances it has been fully demonstrated that lenses can be kept fog and moisture free.

3rd. The question of fogging, as Dr. Young<sup>1</sup> says, "may be dismissed if we only stop to consider that fogging only occurs when going from a cold air into a warm one." My experience in an engine cab has been that glasses so fogged are perfectly clear in less than five seconds on putting the head out of the window and coming in contact with the cold air again. This fogging interferes with the engineman seeing distinctly the various mechanisms about the cab for a few moments, but he is equally unable to see for the same length of time as a result of coming in contact with snow, sleet, rain and wind with the unprotected eyes.

4th. The danger of glasses becoming broken when in position on one's face is almost nil. I can recollect of only one instance—a young man was struck in the face with a billiard cue and rimless glasses broken. A blow sufficient to break rimmed glasses on the wearer's face would in all probability be enough to completely disable him from continuing with his work. Dr. Chas. Lukins<sup>2</sup> in a report of 76 cases of perforating wounds of the eyeball says, "broken spectacles were responsible for two cases, a blow having shattered the glasses and driven a fragment through the tunics of the eye."

5th. That glasses which give  $20/20$  vision in the examining room do not give an equivalent vision when used at long distances is referred to by F. Ard and Geo. de Schweinitz (see appended answers). However, if a man's vision in the examining room is found to be reduced to say  $20/40$  in each eye, or  $20/70$  in one eye and  $20/50$  in the other, and can be brought up with glasses to  $20/20$  in each eye separately, "he certainly is safer as an employe with his refraction properly corrected than he would be without such correction."

6th. That vision is better without correcting lenses in dusk or darkness, is asserted by well known authorities.

Dr. W. Harvey Smith says "I believe it is the experience of most wearers of glasses, especially of persons who have not marked deterioration of vision, that in semi-darkness or at dusk vision is better without than with correcting lenses." He explains the condition as follows: "I believe the explanation of the phenomenon mentioned is, that rays of light passing from a rare into a denser medium undergo some retardation of their progress. The amount of retardation depending upon the density and character of the medium and the quality and intensity of the light. Further, the position and direction in which lenses are worn before the eyes must have an important bearing upon the point raised in my recent communication to you."

Dr. J. A. White writes: "As to the matter which I bring up of a person of  $20/40$  or  $20/60$  vision seeing better without glasses at night than in the day, you ask me for an explanation. I can not give you any; I have been puzzled over the thing for a long time and can not understand it.

“First, to start with myself, I have a vision in the right eye of  $\frac{20}{20}$ , in the left of  $\frac{20}{40}$ , simple hyperopia, all of which I have developed since I was 45 years of age. Prior to that it was latent. My glasses give me  $\frac{20}{10}$ . Now at night, out of doors, I see better without my glasses; the darker the place the better I see without them. Where there is bright electric light, I see better with the glasses. I read your note last evening, and in walking up town some distance I took particular pains to test my glasses, and except in the brightly illuminated places I saw much better without them. Several blocks off I noticed there were some red and white lights to show some street repairs that were going on. My glasses enabled me to see these lights more sharply defined in outline, but no better. Without the glasses they were stellate in appearance.

“As I never heard any reference to this matter, I thought it was my own peculiarity for a long time, but after questioning a great number of people on the subject and since their attention has been called to it, they state they find the same thing. I passed through Philadelphia the other day and my niece, who is a patient of Dr. de Schweinitz, happened to make the remark that she saw much better without her glasses at night than she did with them. She has hyperopic astigmatism. My assistant hearing me dictating this letter to you, remarked that he thought everybody was that way; because he has worn glasses for a long time and practiced medicine in the country, and says that when driving at night he always took his glasses off because he saw better without them. I don't know whether this has any dependance on the pupillary action with or without glasses on; I have never investigated it closely and have no theory to advance. At the same time, it is a matter for consideration for enginemen on the railroad.”

Dr. H. B. Young states:<sup>1</sup> “The lamp signals stand out better with  $\frac{20}{40}$  than with  $\frac{20}{20}$ . This is explained when one considers that with  $\frac{20}{20}$  the effulgent rays can be made out. These effulgent rays give a twinkling, unsteady effect, which is still further accentuated by the jolting of the engine. With  $\frac{20}{40}$  these effulgent rays are blotted out and the lamps stand out as illuminated discs.” This was also my experience.

At the much lessened distance I could make out the lights with  $\frac{20}{40}$  (6/XII) V., but I could make them out much more clearly and at a much greater distance with  $\frac{20}{20}$  (6/VI) V., as cited above; and again, if there were a number of lights displayed, as are usually seen in railroad yards, the proximity of these illuminated discs was very confusing.

As everything in the universe is seen by reflected light, excepting self-luminous objects, my idea as to the diminution of vision observed by wearers of glasses after dark, is that the lenses reflect so much of the small amount of light coming from these various objects after nightfall as to make a decidedly noticeable diminution in the vision. Also there is some absorption by the denser medium of the glass, as Dr. Smith suggests. There is so much light in the day time that this loss from reflection and absorption is unnoticed. Dr. White states his glasses enable him to see the lamps in the street more sharply defined in outline. As night signals for railroads are self-luminous objects, the question of diminution after dusk cannot be considered an objectionable factor against glasses.

7th. The legal aspect in case of accident was brought up by A. E. Manchester, Superintendent of Motive Power, Chicago, Milwaukee & St. Paul R. R., i. e.: "There is a general feeling that a man wearing glasses has not as good general eyesight as one who sees without glasses, and in case of accident lawyers take advantage of every point of this kind and make it unjustly embarrassing and sometimes expensive to the company. The one thing that will overcome this feature will be that conventions of oculists and men who are expert in this calling will take the position that a man's eyesight is as good or better when the man is provided with glasses that bring his eyesight to normal, than is a man without them. If this cannot be done, there is always a question of hazard to the company in having men in the service who wear glasses."

From my experience too much cannot be said in favor of enginemen and firemen wearing glasses, either for protection or when long in service, to correct refractive errors.

The following are some of the distinct advantages of glasses:

1st, The correction of refractive errors of men long in service.

2nd, Protection against wind, dust, mist, rain, snow and sleet.

3rd, Relieving the reflection when running beside rivers or lakes, from snow in the winter and sand in western deserts.

4th, Overcoming the disturbance of vision when running toward the rising or setting sun.

5th, Doing away with the heat and glare from the fire-box in stoking.

The men who make the fast runs with our "limited" trains, have been advanced to such duties by a process of selection, a sort of "survival of the fittest." The experience attained, ability to meet the increasing demands of his occupation, and the additional caution acquired, are all results of his long years of service, and in reality are what have secured him his position and entitled him to hold it. *These qualifications without good vision endanger life and property*, but with his vision brought up to the required standard by the use of lenses, he has the knowledge that his past record has entitled him to the respect and trust of the officials of his road to spur him to the best performance of his duties.

The protection afforded the eyes by glasses against the impact of wind, dust, rain, snow and sleet, when an engine is travelling from 35 to 70 miles an hour, can only be appreciated by one who has experienced it, and it is absolutely necessary for an engineman to have his head out of the cab window more or less, in order to be sure of his signals in such weather conditions. Fully 90 per cent. of the enginemen I have ridden with carry some sort of protection glasses for such emergencies.

The objectionable reflection from snow, and while running beside bodies of water, the disturbance of vision when running toward the rising or setting sun, and the relief from the heat and glare of the fire-box, is naturally accomplished by use of colored lenses. All colors were tried; the best and only satisfactory result was obtained with the amber lenses. With this color before the eyes there is a seeming, if not absolute increase in the vision. Objects of like hue at a distance stand out distinct and plain—for instance a semaphore

signal with a bad background. One can look indefinitely into the fire-box and see all its parts, relieved of the heat and glare, and then climb up on the cab seat and distinguish signals with ease, the scotoma produced by looking into the bright fire with the naked eye being absent.

The protection of firemen's eyes seems of especial importance to me for the reason that the engineman almost always calls on his fireman to verify signals located at points of importance or where the signal is somewhat obscure; and with the scotoma produced in the naked eye from the fire-box this is almost impossible.

The colors of the night signals used in railroading that have to be recognized at a distance—red, white, green and yellow—are not affected by the amber lens to any extent. The white is tinged a slight yellow; the yellow is made a deeper yellow; the green, especially if it contains much blue in its composition, is made a more decided green on account of the yellow in the amber being a complimentary color of the blue and neutralizing same. The red is absolutely unaffected. The blue lights used for back lights, and on some roads to designate car repairing, are considerably diminished by the amber lenses, but this color is not used for the control of trains in block systems. The blue and violet rays of the spectrum are the chemically active rays and the ones which cause irritation of the fundus and diminution of vision when the eyes are exposed to them for any length of time. The amber lenses neutralize these rays and so protect the eyes from them.

Col. Sam. Reber of the signal corps, U. S. A., in a recent conversation spoke of the increase in vision obtained by the use of amber eye-pieces in field glasses, especially on bright days with a blue sky for a background or a bluish haze; the distant objects were made to stand out sharp and distinct. Through the kindness of F. A. Hardy & Co. I have obtained a pair of these, and the difference in vision with them is quite marked.

In order to obtain the opinions of ophthalmologists throughout the United States as to the safeness of a railroad employee wearing glasses, the following circular letter was sent out:

"MILWAUKEE, Wis., March 16, 1905.

"DEAR SIR:

"The constantly occurring railroad accidents have caused considerable activity along many lines, with a view to provide greater safety to passengers, employees and property.

"With the present method of controlling trains by signal, block, and otherwise, the vision and color perception of a railway's employees is of the greatest importance.

"Considerable discussion has arisen as to the use of glasses by *old employees* while on duty, especially enginemen and firemen.

"A short time ago I was asked for an opinion as to whether an old employee, whose vision on re-examination falling below required standard, there being no ocular disease, color perception meeting requirements, and glasses bringing vision up to the required standard, could be considered a *safe* employee.

"The following opinion was unhesitatingly given, as a result of the experience in riding considerably over 6,000 miles in the cab of an engine, at all times of the day and night, in all kinds of weather, with and without glasses. (See paper read before the Ophthalmic Section A. M. A., *Jour. A. M. A.*, Feb. 18th, 1905):

"It is my professional opinion that a railroad employee (engineman or fireman) who has been in continued service for a period of not less than five years and who on re-examination falls below the required standard of vision, and such vision can be brought up to said required standard with glasses, his color perception meeting the required standard and there being no ocular disease, *is a safe employee*.

"Such employee should be required to carry at least one extra pair of glasses.

"Such employee should also be re-examined semi-annually to ascertain if there has been a further decrease in vision and if the glasses fully correct the visual defect.'

"Your answer to following questions will materially aid in establishing the consensus of opinion of the best authorities in the country upon the subject.

"I—Would you consider a railroad employee *a safe man*, as far as his vision is concerned, who has been in continuous

service for not less than five years and on re-examination his visual acuity was found below the required standard, there being no ocular disease, color vision meeting requirements, and his vision being raised to the required standard by the use of glasses?

“II—Should there be a minimum standard of diminution of vision for employees in this class?

“III—What would you consider the minimum amount of vision such an employe should possess to be promoted in service with glasses bringing his vision up to required standard?

“IV—How often, in your opinion, should men falling in the above class be re-examined to ascertain if there be a further loss of vision and determine if the glasses fully correct the defect?

“V—Approximately, what percentage of spectacles in your experience are broken by accidental or other means while on the wearer's face?

“VI—Can you consistently agree with the opinion given above?”

There are some answers from railroad surgeons and some from railroad officials. All the answers are appended to the paper. 463 affirmative answers were received, 22 negatives, and several with certain exceptions or provisions.

Following are some of the arguments brought to bear by those answering in the negative:

Dr. N. O. Nance states: “My opinion is formed entirely from my own experience in use of glasses for constant wear, and relate chiefly to ‘fogging’ of the lenses incident to exposure to a drizzling rain or the alternate effect of extreme cold and heat. I am satisfied that at times, under conditions just mentioned, my vision is less than  $\frac{10}{200}$ , which must be admitted by all is much too low for safety. Perhaps from a practical standpoint this opinion has no bearing whatever—I am not prepared to say; but since the receipt of your letter, one evening recently while out automobiling in a drizzling rain, I took occasion to imagine myself in an engine cab, looking ahead on the street with two Acetyline lanterns for a headlight. The result was very disappointing indeed, so much so that were I in a railroad train engineered by one with such defective vision as I possessed under the circumstances, I would most certainly have felt all but safe.”



This is true of automobiling where the driver is exposed to the climatic conditions continually, but an engineman is only exposed when he puts his head out of the cab window to determine a signal more plainly, his cab windows being blurred with rain and interfering with vision. The track ahead is not illuminated sufficiently with the oil headlights for him to observe any object in time to control his train for it, (the electric headlight illuminates sufficient distance to see a semaphore at  $\frac{1}{2}$  mile) so very little attention is paid to the track at night—he is watching for a signal light in the distance, which will inform him whether the block ahead of him is clear or occupied. Again, the weather conditions themselves are against distance vision, glasses or no glasses.

Dr. M. H. Post says: "From my knowledge of refraction and my own experience in driving, bicycling and running an automobile (I am almost 54) I am very positive in my opinion that I should answer 'yes' to your first question. I did not require glasses for any purpose until after I was 40, and I do all the above mentioned things with bifocal glasses." (Wears  $O^2 + 1.75 \text{C} + .50 \text{ 90}^\circ \text{ V} = \frac{20}{12}$ ).

Dr. L. A. W. Alleman replied "no" to question No. 1, but in a letter received later states: "The very first ride on an engine convinced me that you were quite right in your contention, and I question the safety of engineers who do not have a protecting glass."

Dr. F. G. Steuber answers: "While not desirable, ought to be continued in service," and cites a case of an engineer "whose vision without glasses is very low, with glasses about  $\frac{20}{30}$ , yet he has told me that he rarely uses the glasses and does not like to wear them. I enquired, 'How does it happen that you, having a fast run, have never had trouble?' 'Am exceedingly cautious, watch the time,' etc. Certainly this man is of more than ordinary intelligence, excellent judgment, sober in the fullest sense, has been my patient for years, yet the facts are as stated."

This brings up the question of the personal equation of the men, referred to by Dr. W. K. Rogers, i. e.: "The personal equation as I have mentioned under question No. 1 must count for a great deal. An engine driver of 15 or 20 years experience is usually a much safer man, with consider-

able error of refraction corrected by glasses giving from  $\frac{6}{10}$  to  $\frac{6}{6}$  vision, with all their disadvantages, than one of four or five years service. A man who is tried out and known to possess grit, discretion and presence of mind, cannot be readily classified, and while the surgeon adhering to the letter of the fixed standard would be obliged to report adversely upon the physical qualifications, his personal characteristics are too rare to allow this to be an arbitrary bar to his employment."

Dr. James A. Spaulding says, "Yes, except all lenses are liable to blur in frosty weather from changes of temperature. Opening the furnace or fire-box will occasionally throw out hot air which will condense on spectacles of engineers for a short time. If wearers are careful about this, as well as about leaving engine and going into the warm station rooms, I see no risk in their wearing spectacles for the hypermetropia or astigmatism of advancing years."

Dr. W. Harvey Smith writes: "Replying to your communication of the 16th inst., relating to the visual requirement of railroad employees: I do not agree with the opinion expressed in your paper appearing in the *Journal of the American Medical Association*, on the 18th of February last, for the following reasons:

"Persons wearing glasses who reside in the colder portions of the American continent, find when the temperature is low (in northwestern Canada for several weeks every winter the thermometer shows a range of from zero to 40 below) that upon going from the cold outer air into a warm atmosphere, an annoying condensation of moisture occurs on the lenses that are being worn, preventing the wearer from seeing for several minutes, or until the glasses have been cleaned. This would of course be more marked in the presence of steam, and as engineers and firemen are obliged sometimes to leave the cab of their engine to inspect or make repairs, or in order to see more clearly must sometimes open the cab window, it follows that glasses instead of being of value, would in this country in winter be positively dangerous.

"I believe it is the experience of most wearers of glasses, especially of persons who have marked deterioration of vision, that in semi-darkness or dusk, vision is better without than with correcting lenses. With this latter objection excepted,

I think that possibly the employees of southern railroads might not be regarded as dangerous if allowed to wear correcting lenses. But speaking for the western portion of the Canadian Pacific Railway, I consider the adoption of your views would in the Canadian Northwest, in winter especially, tend towards increasing the loss of life and property which results from visual disability on the part of employees, while general approval and adoption of your recommendations would in my opinion tend to undo much of the good that has already been done in educating railway officials to the necessity of protecting life and property by the adoption of a high visual standard."

The "fogging" from exposure to cold was spoken of earlier in this paper, and it should be remembered that the blurring referred to by Dr. Smith takes place after glasses have been exposed to the cold for a more or less long period of time, while the engineman only has his head out of the window for a few moments at a time and the "fogging" does not last as long; further, as the glass does not become as cold, the moment the lenses are exposed to the cold again the fogging disappears. It must be admitted that this feature is a strong one against glasses; however, the effect of the intense cold Dr. Smith speaks of on the unprotected eyes when running at a high rate of speed, is of great, if not a greater disturbance to vision and interferes as great a length of time as "fogged" glasses. Vision at dusk being better without correcting lenses, was referred to above.

Here are a few replies with exceptions or modifications:

Dr. J. W. Chamberlain: "In some cases yes, others no."

Dr. L. I. Dixon: "Fairly safe, except for unforeseen accidents depriving him of his glasses." Dr. F. B. Eaton: "Generally yes, excepting when engineer of passenger is with only one fireman or engineman in cab." Dr. Clark W. Hawley: "Only on branch lines; not on mail or fast trains."

Dr. W. K. Rogers: "Generally speaking, yes; but personal equation must be counted, and a minimum of such eyes should be reached by excluding latent hyperopes, etc." Dr. G. W. Allyn: "Yes, if standard with glasses does not fall below  $\frac{20}{30}$ ." Dr. F. M. Chisolm: "When  $\frac{20}{30}$  in one eye without glasses; otherwise not" (enginemen and firemen).

Dr. C. R. Holmes: "Yes, if his refractive error was of moderate degree." Dr. Lucian Howe: "Depends on the degree which the vision is below the required standard (should not be below  $\frac{6}{10}$  at least in one)." Dr. B. C. Kelly: "Yes, provided the uncorrected vision was not less than  $\frac{20}{30}$ ." Dr. Chas. W. Kollock: "Yes, if he did not require a stronger than + 2 for constant use." Dr. B. L. Millikin: "Yes, provided the required standard be normal vision." Dr. H. H. Seabrook: "Yes, unless uncorrected vision is below 0.4 ( $\frac{20}{50}$ )." Dr. Elmer G. Starr: "Yes, as provided in answer No. 3" ( $\frac{20}{40}$  in each eye tested separately). Dr. C. A. Veasey: "Not if his vision was less than  $\frac{20}{30}$ ." Dr. M. M. Cullum: "Yes, with certain limitations \* \* \* —a man's vision should be at once quick and accurate \* \* \* —for instance, two men may have a recorded vision of  $\frac{20}{20}$ , but one will pick out the letters quickly, accurately and confidently, while the other will get them slowly, laboriously and uncertainly." Dr. Hermann Knapp: "If a perfect field in either eye is required." Dr. Arnold Knapp: "Yes, except to the frequency of examination. Depends on case."

Questions No. 2 and No. 3 received the greatest variety of answers. Some replied, "No standard of diminution is necessary if glasses bring the vision up to the required standard." Other answers varied from  $\frac{10}{100}$  vision to  $\frac{20}{20}$ . Claude Worth (London) suggests regarding the minimum amount of vision without glasses: "He should, I think, be able in the event of glasses being lost, by the exercise of especial caution, to safely discharge his duties to the end of the run without them." Dr. T. C. Hood writes: "A railway engineer, patient of mine, age 47, is myopic, has without glasses R. V. =  $\frac{9}{200}$ , L. V. =  $\frac{20}{60}$ . With glasses R. V.  $\frac{20}{30}$ , L. V.  $\frac{20}{30}$  +. Service fifteen years. I consider him a safe man."

I gave an opinion, "Any one possessing  $\frac{20}{100}$  vision in one eye, the other having either better or worse vision, if, with glasses, the vision can be brought to normal in each eye, there being no ocular disease and color perception normal, is a safe engineer. It would be a rare case of a man with so low a grade of vision, without glasses, to have gotten into service in the first place; secondly, there would undoubtedly be more or less ocular disease present to account for such a diminution, which would exclude him."

Question No. 4, as to the frequency of examinations, the answers were from quarterly to once each three years. It was also suggested that "this should depend upon the cause and degree of the defect," the "age," "time of service," and "the surgeon who sees case should decide date of next examination."

Dr. W. H. Snyder suggested at the Annual Surgeons' Meeting of the Wabash road: "A re-examination of all our men before the fair at St. Louis. This was done and not an accident was caused by poor eyesight." Snyder also suggests re-examination "every year at no expense to the employee."

My idea is that up to the age of 35 men should be examined each three years and after any severe illness or accident, or any occurrence which seems to cast doubt on the visual capacity of the individual. Re-examinations should also be made more frequently of men known to be suffering from syphilis, albumenuria, diabetes or acute or chronic eye diseases. They should always be examined before promotion. After 35 they should be re-examined semi-annually to ascertain if there has been any further change in vision, or, if glasses are worn, if they correct the visual defect."

The following are some of the pertinent suggestions contained in the answers:

Dr. W. A. Snyder, Ophthalmic Surgeon, Detroit and Eastern Division Wabash R. R., states: "It is practically *impossible* to get a great number of enginemen who have perfect vision at the age they usually are when they get fast runs."

Dr. F. O. Marlowe writes: "In examining railroad men I have often felt that a grave injustice is done to them in accepting them with a static refraction of such kind that by the time middle age is reached the visual acuity *must* fall below the required standard, i. e., cases of a high degree of hypermetropia or hypermetropic astigmatism. Consequently it has seemed to me desirable to take into consideration not only what the vision is at the time of examination, but also what the static refraction is, and therefore what the vision *will* be when the man is between 40 and 50 years of age. Unless the use of glasses is unconditionally permitted, this seems to me a very important matter."

These are very important features and can not be eliminated with the present method of having candidates for employment examined by men who have not been scientifically trained for such work. Dr. Frank Allport "strikes the nail on the head" in the following: "I shall hope to see a day when all roads will unhesitatingly employ eye and ear surgeons who shall have charge of this department of the road and whose duties it shall be to see that all employees are properly examined." Until such a time, a certain proportion of old and trusted employees will have to wear glasses to continue their work, if a safe standard of vision is maintained.

Dr. Geo. de Schweinitz thinks "There is a good deal of value in Oliver's suggestion that a good many of these tests ought to be made at long ranges with suitable enlargement of the test object." Dr. J. R. Sturtevant suggests that "at least 00 eye with rims should be used, 000 better, and in presbyopes, the depressed bifocals should be designated as reducing confusion to a minimum. Dr. J. A. Ellwood calls attention to the "cases with normal vision in one eye and and sub-normal vision (even after correction of errors of refraction) in the other, occurring in old employees." A. Duane refers to monocular diplopia. Dr. C. R. Ellwood refers to the non-medical examiner "sometimes being a little bit hasty or arbitrary and that an injustice is done the applicant for the engine \* \* \* especially when the case is referred to the ophthalmologist of the road and he sustains the non-medical examiner's opinion on principle." Dr. A. I. Bouffleur, Dr. Jno. E. Owens, Dr. C. D. Wescott and Mr. A. E. Manchester do not believe a fireman should be promoted to the position of engineer, if glasses are required to bring vision up to the required standard.

Dr. A. I. Bouffleur says: "I do not believe a fireman should be promoted if glasses are required, unless the defect has resulted from his employment. As to engineers, I should think that a sliding standard would have to be made, depending upon age and years of service, as there are other things to be taken into consideration in reference to his qualifications than his eyesight," and gives his reason. "Most firemen come up for promotion on the Milwaukee road in four to eight years; they are also as a rule young men from 18 to 25 years of age. I hold that if in these young men sufficient change

in sight has occurred in the first few years of their employment so that it is necessary to utilize glasses to bring their vision above  $\frac{20}{20}$  and  $\frac{20}{30}$ , that the prospects of their becoming incapacitated at a comparatively early time in their life as an engineer is such that they should not be promoted, unless this defect has been brought about by their work. If a man is promoted at 30—which is late with a defective sight—what will the man be at 50 or 55? This point is of particular value when the question of pension comes into consideration; but my opinion is formulated wholly upon the proposition as to the safety of the employee. In other words, if a man's eyesight is normal at 20 and deteriorates 50 per cent. in six to eight years, except as the result of trauma, he would naturally become totally incapacitated before he reaches the age of 60. As an engineer has already passed through the experimental stage, and is older both as an employee and in years, the rapidity of change must necessarily have been much slower, and therefore the greater likelihood of his filling a full expectancy as an employee."

The conclusions reached are:

1st. That the protection afforded by glasses is a distinct advantage to enginemen and firemen.

2nd. That the disadvantages of glasses in railway service are not sufficient to render an employee unsafe who wears them for protection or to correct a latent refractive error made manifest by increasing age.

3rd. That wearing glasses for protection of the eyes in railway service will tend to prevent the reduction in vision usually found occurring in enginemen at 40 to 50 years of age.

4th. That the only method of eliminating glasses for distance in railway service in the future, is to have all applicants for employment examined for latent refractive errors when they apply for a position, by men scientifically trained for such work.

5th. That it is the consensus of opinion among the ophthalmologists of the United States that an engineman or fireman wearing glasses on duty is as safe an employee as one without them, if not safer.

<sup>1</sup> Young, Dr. H. B., The Visual Requirements of Trainmen, Based on Personal Observations From an Engine Cab, *Annals Ophthal.*, Jan. 1904.

<sup>2</sup> Lukens, Dr. Chas., Rupture of the Eyeball, *Annals Oph.*, July, 1900.

Name.	Question I.	Question II.	Question III.	Question IV.	Question V.	Question VI.
Allemann, L. A. W.	No	Yes	20/50	Yearly	1/10 of 1%	No
Barnes, J. Steele	No, generally;	Yes, for	20/30-20/40 for	Quarterly	1 in 300	No
Bull, Chas. Stedman	Except'n'y yes No	exceptions	exceptions		3%	No
Bullard, Wm. L.	No	No		Not at all	Don't know	No
Chisholm, F. M.	When 20/30 in 1 eye without gl.; otherwise not			6 mos.	Small	
Coggin, D.	No, because of rain and snow on lenses obscuring V.					No
Denney, J. A. Chief Surg. C.B.& Q.R.R.	No	Yes	20/30 with both eyes open for engineers. 20/40 for train and yardmen	Yearly	Don't use them	Not with No. 1
Derby, Hasket	See Remarks					
Elmer, A. W.	Yes— See Remarks	Yes	20/40 in one and 20/80 in other	Yearly	Less than 1%	
Hall, W. D.	See Remarks					
Jeffries, B. Joy	Most certainly not	Yes	Only V=20/20 each eye. No gl.	No gl. should be allowed or needed	Not many brok- en. All too dirty not	Most certainly not
Kipp, Chas. J.	No	Yes	6/6 without gl.	3 years		No
Magee, R. S. Oculist and Aurist for A.T.& S.F. R.R.	No	Yes	No	6 mos. to 1 yr.		No
Nance, Willis O.	See Remarks			6 months	1/10 of 1%	
Oliver, Chas. A.	No, there must be normal vision (uncorrected) for distance in each eye				5 to 10%	
Phillips, Wm. H.	I question his being safe				Cannot say	
Rogers, F. T.	No				1/10%	No
Smith, W. Harvey	See Remarks					



## Remarks.

Letter March 7, '05.

The chief danger, I take it, from a man dependent upon a glass for necessary vision is the clouding due to steam or change of temperature. The danger from broken glasses is very slight; but should it happen, it would be most likely to be at a time when changing glasses would involve a serious loss of time. (The following is extract of letter dated May 25th, '05, after having ridden in an engine cab.) My very first ride in an engine convinced me that you were quite right in your contention, and I question the safety of engineers who do not have a protecting glass.

Questions II, III and IV I have not answered because I have answered No. I in the negative. I assume that the term "railroad employe" refers to engineers, firemen, brakemen, switchtenders and conductors or in other words all out door employes engaged in the switching, dispatching, and management of trains and does not include indoor employes.

In general, no; it depends upon the amount of vision without glasses.

In this vicinity I believe new men who are H. cannot be appointed as engineers, although old engineers are allowed to wear glasses. After a few years it is likely glasses will not be seen in the cabs.

Does not consider a railroad or steamboat employe whose vision requires to be brought up to a useful amount by the use of glasses a suitable person to be entrusted with the lives of the community. In a great emergency, where instant action is necessary, the glasses might become clouded, broken, or lost. It is true that the chance of this occurring is comparatively small, but still a distinct risk is involved. Normal vision with the unaided eye he would therefore consider both desirable and necessary.

The answers apply to all others than enginemen—I don't think any man on the engine should wear glasses and that should be decided when he applies for the position as fireman. If applicant has more than 1 D. H. he should be rejected.

I believe that no man should be allowed to control an engine (R. R.) whose distant V. is below 5/5 Sn. and would eliminate hyperopes if V. falls below, even though improved by + gl. Would like to exclude the presbyope (steam gauge, etc.). Have of course no practical experience in running a locomotive, but feel, selfishly no doubt, that with one life to enjoy, the least the traveler may demand from the R. R. management is absolute visual acuteness and sobriety in the engineer, and the same as regards the fireman if he is later to assume the duties and responsibilities of the engineer. The percentage of glasses broken, is, I should say, small, when on the patients' face.

I still must insist on 20/20 V. for engineers and firemen on entrance to R. R. duty, then we should not have reduced V. from H. subsequently.

Do not permit the wearing of gl. for engineers or firemen only for reading their orders.

I do not consider a R. R. employe (an engineman) a safe employe when wearing glasses. My opinion is formed entirely from my own experience in the use of glasses for constant wear and relates chiefly to the fogging of the lenses incident to exposure to a drizzling rain or the alternate effect of extreme cold and heat. I am satisfied that at times, under the conditions just mentioned, my V. is less than 10/200, which it must be admitted by all is much too low for safety. Perhaps from a practical standpoint this opinion has no bearing whatever; I am not prepared to say, but since receipt of your letter, one evening recently while out automobiling in a drizzling rain, I took occasion to imagine myself in an engine cab looking ahead on the street with two acetylene lanterns for a headlight, the result was very disappointing indeed, so much so that were I in a railroad train engineered by one with such defective V. as I possessed under the circumstances, I would most certainly have felt all but safe. If employes must wear glasses their eyes should be re-examined at least every 6 mos.

(Dr. Oliver in conversation with the writer said the man was an efficient employe, but not safe).

Nothing but practical tests would ever make me believe that an engineer wearing glasses is a safe driver in all kinds of weather. Personally I wear a high cylinder, and in rainy, misty weather, I never feel safe for a moment driving my automobile, as I cannot see, although under favorable conditions I have 20/15 V. I believe that safety demands that all sentiment be laid aside and that the requirements of V. in an engineer be up to the limit. If there be any question after a fair test, err on the safe side. 20/20 without glasses and not more than 1 D. latent hypermetropia, or .25 astigmatism, is not too rigid.

My personal experience in rainy and foggy weather, when I can neither see with my glasses or without them, and the difficulties I have had in automobiling, lead me to deem the necessity of gl. an element of danger. I know of no reason why an engineer should not have the same difficulty. I appreciate what you say regarding heat and cold, but I agree with you in that if that were the only objection to wearing the glasses, it would be quite safe.

Persons wearing glasses who reside in the colder portions of the American Continent find, when the temperature is low, (in Northwestern Canada for several weeks every winter the thermometer shows a range of from zero to 40° below), that upon going from a cold outer air into a warm atmosphere an annoying condensation of moisture occurs on the lenses that are being worn, preventing the wearer from seeing for several minutes, or until the glasses have been cleaned. This would of course be more marked in the presence of steam, and as engineers and firemen are obliged sometimes to leave the cab of their engine to inspect or make repairs, or in order to see more clearly must sometimes open the cab window, it follows that glasses instead of being of value would in this country in winter be positively dangerous.

Name.	Question I.	Question II.	Question III.	Question IV.	Question V.	Question VI.
Sterling, J. W.	No, the blurring of lenses from steam, oil, and cold air in winter is the great drawback for engineers, etc.					
Van Slyke, F. W.	No	No	Normal with-out gl.	Never	Train personal unknown 5%	No
Van Nolte, Wm. B.	No					
Woodward, J. H.	No					No
Abaly, W. C.	Yes	Yes	20/30	Once or twice a year	About 1/2%	Yes
Abbe, Alanson J.	Yes	No		Every 2 yrs. bet. age 35 & 40. Ev. yr. 40 to 47; Ev. 5 yrs. 47 to 60	Very small; less than 1%	Yes
Adams, A. L.	Yes	Yes	6/9 both eyes	Annually	2%	Yes
Adams, A. E.	Yes	Yes	20/50	Yearly	A very small fraction	Yes
Adams, C. F.	Yes	Yes	6/9	12 mos.	1 in 12 mos.	Yes
Albro, M. Z.	Yes	See Remarks	See Remarks	6 mos.	No idea—very small	Yes
Alcorn, D. N.	Yes	No—See Remarks		Annually or semi-annually	Very small, have never known but 3 or 4 such	Yes
Alkire, H. L.	Yes	Yes	15/30	Every 6 mos.	Very small	Yes
Alleman, L. A. W.	Yes	?	20/200	Once a year	1/2 of 1%	Yes
(See negative replies)						
Allen, Geo. F.	Yes	Certainly	20/50	4 to 6 mos.	1/10 of 1%	Yes
Alling, Arthur N.	Yes			About once a yr.	Comparatively very few	Yes
Allport, Frank	Yes	20/20 & 20/30	Yes	Every 3 yrs.	Hardly any	Yes
Allyn, C. W.	Yes, if standard with glasses does not fall below 20/30	First-class men Yes	Not less than 20/30 with gl.	When a defect is discovered he should be examined every 2 mo. case of shattered until cause has gl. 3 days ago been discovered	With metal workers quite frequently. Had in case of shattered gl. 3 days ago	Yes
Alt, Adolf	Yes	I do not see why if V. can be brought up to 20/20 with gl.		Once a year	A very small percentage	Yes
Alter, Francis W.	Yes	Yes	20/30	Every 2 yrs.	1/10 of 1%	Yes
Andrews, Albert H.	Not sufficiently unsafe to justify dismissal	No		At least yearly	Very small	Yes if above 45
Andrews, Jos. A.	See Remarks					
Anten, Frank E.	Yes	No		Annually	Have no record	Yes
Archibald, O. W.	Yes	Yes	20/30	Every 3 to 6 mos. Circumstances the guide	Don't know	Yes
Ard, F. C.	Yes	Yes	20/50 monocular vision	6 mos.		Yes
Babeock, W. D.	Yes	Yes	20/30	Yearly	2%	Yes
Bach, Jas. A.	Yes	Yes	20/40	Annually	5%	Yes
Bachenstoe, M. J.	Yes	Yes		Half yearly	2%	Yes
Bailey, Wm. J.	Yes	Yes	6/6 one eye, 6/12 other	Every 6 mos.	1/2 of 1%	Yes
Baker, A. R.	Yes	Yes	20/70	6 mos.	Less than 1%	Yes
Baker, Chas. H.	Yes	Yes	20/40 binocular	At least yearly	Less than 1% when lenses are in rims	Yes
Baker, H. B.	Yes	Yes	5/10	Yearly	1/2% ?	Yes, if these men are healthy

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 Remarks.
 

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I believe it is the experience of most wearers of glasses, especially of persons who have not marked deterioration of V. that in semi-darkness or at dusk, V. is better without than with correcting lenses. With this latter objection, excepted, I think that possibly the employees of Southern railroads might not be regarded as dangerous if allowed to wear correcting lenses, but speaking for the Western portion of the Canadian Pacific R. R., I consider the adoption of your views would in the Canadian northwest, in winter especially, tend toward increasing the loss of life and property, which results from visual disability on the part of employees while general approval and adoption of your recommendations would, in my opinion, tend to undo much of the good that has already been done in educating railway officials to the necessity of protecting life and property by the adoption of a high visual standard.

Greatest safety, rather than "greater safety" is needed, especially in the United States.

An engineman should not wear gl. because of rain and snow fogging them.

Normal vision without glasses and re-examination every year after the fortieth year for engineers and firemen and a minimum requirement for them of 6/6, and normal color perception.

If glasses are permitted and do bring vision up to standard, diminution may be of little consequence.  
 (III) No minimum of V. can be fixed upon if gl. are permitted and bring V. up to standard  
 (II & III) If he has been a safe man for 5 yrs. and eyes sound, it is hard to see how he could fall below safe from purely refractive defects.

I quite agree with you in the opinion which you have expressed in regard to safety of employing an engineman whose vision can be brought up to required standard with gl., providing his color perception meets the required standard

I believe an engineer of 5 yrs. experience who has traveled over the road many hundreds of times, who has a vision of 20/50 in each eye without a correction of his refractive error, and with a correction has a vision of 20/20, this same engineer with a pair of glasses on his nose and another pair in his pocket, is a fairly safe proposition. He is so familiar with the objects about him, as a result of long experience, that even without his glasses he is able to see sufficiently well to avoid danger. I have frequently heard the statement from patients whose vision, without glasses is about 20/50 and with glasses is 20/20, that as they look out of the window down the street for a considerable distance, the difference in vision with and without glasses is not so well marked as one might expect.

From close personal observation I believe any person having V. much less than 20/40 of one eye, even if corrected by lenses, has too sluggish perceptions (visual) to be a safe person for railway service.

Name.	Question I.	Question II.	Question III.	Question IV.	Question V.	Question VI.
Ball, M. V.	Yes	Yes	6/12 (useful without gl.)	Once a year	1/10%, mainly in children	Yes
Bane, W. M. C.	Yes	Should be same as without gl.	Same as without gl.	6 mos. to 1 yr.	No data	Yes
Barck, C.	Yes	Yes	6/36	Once to twice yr.	Cannot tell	Yes
Barnstein, Edw. J.	Yes	Yes	20/40	Yearly	Exceed'ly small	Yes
Bartholomew, A. C.	Yes	No		Semi-annually	1%	Yes
Beaudoux, H. G.	Yes	Yes	20/40 for hyperope; 20/70 for myope	Annually for H. Semi-annually for M.	Very small	Yes
Beetham, A. C.	Yes	Yes	15/50	6 mos.	2%	Yes
Bell, E. S.	Yes	Yes	20/40	Yearly	½ of 1%?	Yes
Belt, E. Oliver	Yes	Yes	20/30	Annually		Yes
Bennett, Arthur G.	Yes	Yes with discretion given to examining physici'n	See Remarks	Annually	Rimmed exceedingly few	Yes
Bentley, H. T.	Yes	Yes		At least yearly		Yes
Berens, Bernard	Yes	Yes	20/200	Yearly	Less than 1%	Yes
Bishop, C. Wesley	Yes	Yes	20/100	6 mos until no change	Almost nil	Yes
Blaauw, Edmond E.	Yes					
Black, Melville	Yes	Yes	20/20	Yearly	5%	Yes
Blake, Francis W.	Yes	Yes	15/20	6 to 18 mos. depending on age	Very rare	Yes
Bondurant, A. A.	Yes	Yes	20/40	Yearly	1/10 of 1%	Yes
Bovd, E. T.	Yes	Yes	20/30-20/50	6 mos.	Small	Yes
Bouffleur, Albert I.	See Remarks	See Remarks	See Remarks	See Remarks	See Remarks	See Remarks
Chief Surg. C. M. & St. P. R. R.						
Bradfield, Jas.	Yes	Yes	20/60; after 55 20/120	1 to 3 yrs.	1/10 of 1%	Very nearly
Bradford, H. W.	Yes	Yes	6/10	6 mos.	Rarely	Yes
Braun, Otto	Yes	Yes	20/40	Every 3 mos.	7/10% or less	Yes
Brawley, Frank E.	Yes	Yes	20/50	6 mos.	With rims, practically never	Yes
Breckenridge, H. E.	Yes	Yes	20/75	6 mos.	Very small	Yes
Brinckerhoff, G. E.	Yes	Yes	20/40	Yearly	2%	Yes
Briggs, H. H.	Yes	Yes	20/200 in better eye	Every 6 mos. until constant V. is found; then yearly	2%	Yes
Briggs, Wm. E.	Yes	Yes	6/12	Yearly	Very small	Yes
Brobst, C. H.	Yes	Yes	20/50	Semi-annually or after serious illness.	3% or less	Yes

## Remarks.

I should say something depended on the nature of the error. High grades of astig. might be unsafe even if fully corrected, because of distortion of objects.

The only drawback I can see to a railroad engine driver wearing glasses might be the accumulation of dirt or moisture, or both, on the glasses.

I consider a man with gl., provided his error of ref. is not over 1 D., either H. or M., better fitted to meet all requirements on a running train than the man without, unless he wears shields of the very best glass made

This depends on the kind of refractive error present, myopia requiring a different standard from hyperopia.

A 2 yrs. re-examination will be sufficient except the man being excessive with smoking and drinking. If they are carefully supervised in this regard, much trouble will be avoided. His urine needs the same examination for albumin as the standing position seems to have a malign influence.

Q. 1. Yes, but if he is a fireman I do not think it would be wise to promote him if his vision fell below 20/20, and 20/30 within 5 yrs. If such changes occur in so young a man within so short a time, it will not take long for him to become an unsafe employee.

Q. 2. Yes, but instead of classing the two employments in one, they should be classed in two.

Q. 3. I do not believe a fireman should be promoted if glasses are required, unless the defect has resulted from his employment. As to engineers, I should think that a sliding standard would have to be made depending upon age and years of service, as there are other things to be taken into consideration in reference to a man's qualifications than his eye sight.

Q. 4. Re-examination should depend upon the cause and degree of the defect. Ordinarily once in two years is sufficient, but in special cases, particularly if it is dependent upon constitutional conditions, frequent general examinations, as well as those of the eye, should be made.

Q. 5. I have had no experience of this phase of the subject.

Q. 6. I should answer yes, with the restrictions given in 1 and 4.

Referring to the position which I took in regard to firemen, I will state in addition to what I previously have done, that the age of service has considerable to do with the matter. Most firemen come up for promotion on the Milwaukee Road in 4 to 8 yrs.; they are also as a rule young men from 18 to 25 yrs. of age. I hold that if in these young men a sufficient change in the sight has occurred in the first few years of their employment so that it is necessary to utilize glasses to bring their vision above 20/20 and 20/30 that the prospects of their becoming incapacitated at a comparatively early time in their life as an engineer is such that they should not be promoted, unless this defect has been brought about by their work. If a man is promoted at 30, which is late with a defective sight, what will that man be at 50 or 55? This point is of particular value when the question of pension comes into consideration, but my opinion is formulated wholly upon the proposition as to the safety of the employee. In other words, if a man's eyesight is normal at 20 and deteriorates 50% in 6 to 8 yrs., except as the result of trauma, he would naturally become totally incapacitated before he reaches the age of 60. As an engineer has already passed through the experimental stage and is older both as an employee and in years, the rapidity of change must necessarily have been much slower, and, therefore, the greater likelihood of his filling a full expectancy as an employee.

In answering the 1st question, I would say that in case in which V. did not fall below 6/12 without gl. and could be brought up to 6/6 with gl. in each eye, that such a man would be safe visually for service as an engineer or other train duty. I find that many men who come up to the visual requirements of the S. P. Co. have errors of refraction which need correction very much, and the men would often be much better qualified to do work if the rules allowed them to wear the proper correction of their refractive defects. The engineers here are suffering very greatly since the introduction of the oil burners, from getting sand in the eyes. I think these men would be safer if they habitually wore protecting glasses, even if they did not need the glasses, for correction of defects.

Name.	Question I.	Question II.	Question III.	Question IV.	Question V.	Question VI.
Brose, L. D.	Yes	Yes	20/30	Yearly	Skeleton lenses very often, and should not be worn. Other lenses but fraction of 1%.	Yes
Brown, Ewd. J.	Yes	?	?	6 months until shown to be stationary	Very small	Yes
Brown, Earl J.	Yes	Yes	?	6 mos.	Very few	Yes, fully
Brown, John E.	Yes	Yes	See Remarks	Annually	Very few	Yes
Brown, Sam'l H.	Yes	Yes	6/9	Annually	About 5%	Yes
Bonner, Horace	Yes	Yes	?	At least once a yr., better twice	Very, very small	Yes
Brunner, Wm. E.	Yes	Yes	Probably 6/18, though possibly 6/24	Yearly at least	Very rarely	Yes
Bruns, H. Dickson	Yes	Yes	Not less than 20/30	Yearly	Very few	By all means
Bryant, D. C.	Yes	Yes	75/100	Yearly	Not 1%	Yes
Buckman, Ernest U.	Yes	No		Yearly	Practically none	Yes
Buckner, Jas. H.	Yes	Yes	40/100	6 mos.	1/10 of 1%	Yes
Buckwalter, J. C.	Yes	Yes	20/20	6 mos.	1/2%	Yes
Bullard, T. E.	Yes	Yes	20/50	6 mos.	1/5 of 1%	Yes
Bulson, A. E.	Yes, if gl. give V. 20/20	Yes	Not less than 20/30	Yearly	Very small	Yes
Burnett, Swan M.	Yes	Yes	See Remarks	6 mos.	Very few	Yes
Burrows, Jr. Lorenzo	Yes	Yes	20/50	6 mos.	Not 1 in 1000 if with rims	Yes
Butler, W. K.	Yes	Yes	6/12	6 mos. for M., yearly for H.	1 in 1000	Yes
Cadwell, C. T.	Yes	Yes	20/70	9 mos.	1/10 of 1%	Yes
Calhoun, A. W.	Yes	If gl. make V. normal, I would consider him a safe man	Same as No. II	Once or twice a year	2 or 3%	Yes
Callan, Peter A.	Yes	Yes	2/3	2 yrs.	Almost nil	Yes
Cambert, W. E.	Yes	Yes	20/50	Yearly	Very small	Yes
Cannady, A. A.	Yes	Yes	20/30	Yearly	About 5%	Yes
Connor, Leartus	Yes	No	20/100	6 mos.	2 in 10,000	Yes
Capron, F. P.	Yes	Yes	20/40 or even less, according to individual	6 to 10 mos.	Very small	Yes
Carver, W. F.	Yes	Yes	20/40	2 yrs.	1/5 of 1%	Yes
Carmolt, W. H.	Yes—How much below?	Yes	Would not promise such a man	Depends upon character of error and age		Practically yes
Carpenter, John T.	Yes	Yes	6/6	Yearly	Almost never	Yes
Carrier, Frederic	Yes	Yes	75%	Yearly		Yes
Carrow, Fleming	Yes	No		8 mos. to yr.	Very small	Yes
Carvelle, H. B. W.	Yes	Yes	20/30	Once or twice a year	10 in 17,000	Yes
Chambers, T. R.	Yes	Yes		Yearly	Entirely a personal equation	Yes
Chamberlain, J. W.	In some cases yes, others no	Yes	20/30	6 mos.	Very small	Yes
Chance, Burton	Yes	Not below 5/20	5/20	6 mos.	Seldom	Yes
Chandler, Henry B.	Yes	Yes	4/10	6 mos.	Very few	Yes
Chase, John	Yes	Yes	If gl. give 20/20, does not matter	Yearly	Not 1 in 500	Most heartily
Chattin, J. Franklin	Yes	Yes	20/100	Yearly	1/10 of 1%	Yes
Cheatham, Wm.	Yes	No		Yearly	Very rare	Yes
Cheney, Fredk. E.	Yes	Yes	?	Yearly	Very small in rims	Yes
Church, B. F.	Yes	No, provided V. can be brought up by gl.		6 mos.	1% or less	Yes
Churchman, V. T.	Yes	Yes	20/80	Yearly	1 to 3%	Yes
Claiborne, J. H.	Yes	Yes		6 mos.	Once	Yes
Clap, E. W.	Yes	Yes	20/70	6 mos.	1/10 of 1%	Yes
Clark, C. F.	Yes	Yes	5/9	6 to 12 mos.	1/10 of 1%	Yes
Clark, E. E.	Yes	Yes	20/30	6 mos.	1/4%	Yes
Clement, G. C.	Yes	Yes	20/80	6 mos.	1%	Yes
Cogan, J. E.	Yes	Yes	6/9	Yearly	?	Yes
Colburn, J. E.	Yes	Yes	3/5	Yearly	1/2%	Yes
Coleman, J. A.	Yes	Yes	20/100	6 mos.	Very few	Yes
Coleman, W. F.	Yes	Yes	2/3	6 mos.	5%	Yes
Conkey, C. D.	Yes	Yes	60/40	Yearly	1/10%	Yes

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Remarks.

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It seems to me that some elasticity should be given in reply to this; with V. of better eye approximating 20/30.

I think that the minimum visual acuteness to be allowed an employe, without glasses, should not be lower than 5/20 or 5/30, even if proper glasses bring V. up to normal.

If the standard of V. be 20/20 in each eye, and this obtained by correcting glasses.

I think when very strong concave gl. are required, which reduce the size of the image or the field very much, would be harmful. One objection to gl. with such employes is condensation on a cold lens and not keeping gl. clean. Soap on the lenses, such as we use on our laryngeal mirrors, will partly correct the first. Of course keeping the lenses warm will do it also, but this cannot always be done.

Name.	Question I.	Question II.	Question III.	Question IV.	Question V.	Question VI.
Coover, D. H.	Yes	Yes	2/12+	3 mos.	Mighty few	Yes
Corsen, J. B.	Yes	Yes	6/12	2 yrs.	See remarks	Yes
Corson, J. O. (Examiner for L. & N. R. R.)	Yes	Yes	Not prepared to say, but in very high degrees only	6 mos. for a yr. or so; if no change not so often.	Very small	
Coulter, Chas. F.	Yes	Yes	6/12	6 mos. or less	Less than 8%	Yes
Coultas, R. J.	Yes	Gl. should make V. normal	See Remarks	6 mos.	Less than 1%	Yes
Cox, R. T.	Yes	Practically no		6 mos.	Very small	Yes
Craige, W. G.	Yes	Yes	20/50	Depends on age and ref. cond.	½%	Yes
Crane, C. A.	Yes	Yes	20/40	6 mos.	Not 1%	Yes
Crocker, F. S.	Yes	Yes	20/40 both eyes	Yearly	Not large	Yes
Croskey, John W.	Yes	Yes	20/40	See Remarks	1%	Yes
Culbertson, L. R.	Yes	Yes	5/4 one; 5/6 other	2 yrs.	10%	Yes
Cullom, M. M.	Yes	Yes	20/50	Once or twice a yr. according to kind of error	Not over 1%	Yes, with certain limitations
Culver, C. M.	Yes	Yes	40%	6 mos.	1/10 of 1%	Emphatically
Cunningham, H. M.	Yes	Yes	6/12	6 mos.	None (rimmed)	Yes
Curdy, R. J.	Yes	Yes	20/60	6 mos.	Less than 1%	Yes
Dabney, S. G.	Yes	Yes	20/20	2 yrs.	Very small	Yes
Daviss, E. P.	Yes	20/40	20/40	Yearly	Less than 1%	Yes
Davidson, John P.	Yes	No	Not if lenses bring V. to normal	1 to 2 yrs.	1 in 300	Yes
Davis, E. W.	Yes	Yes		6 mos.	Very small	Yes
Davis, A. E.	Yes	Yes	20/40	2%?	2%?	Yes
Dean, F. W.	Yes	Yes		Yearly	Small	Yes
Dean, G. E.	Yes	Yes	?	Yearly	Very small	Yes, fully
Dean, H. J.	Yes	Yes	20/200	1-1½ yrs.	Very few	Yes
Dennis, David N.	Yes	Yes	4/15	Yearly	1 in 1000	Yes
Dial, E. A.	Yes	No	If no amblyopia & gl. give re- quired standard	Yearly	2%, adults	Yes
Dickinson, Francis	Yes	Yes		Depends on age and how well fitted 1st time	Very few	Yes
Dickey, John L.	Yes	Yes	20/40	Yearly	1 in 1000	Yes
Dietrich, W. A.	Yes	Yes		3 to 6 mos.	Practically none	Yes
Dixon, L. I.	Fairly safe	Yes	1/2	6 mos.	1 in 5000	Yes
Dodd, Oscar	Yes	Yes	20/50	6 mos.	Very few	Yes
Donovan, John A.	Yes	Yes	20/50?	Yearly	Less than 1%	Yes
Dorsey, J. G.	Yes	No		Yearly	1%	Yes
Dowling, Oscar	Yes	Yes	20/50	4 mos.	1 in 1000	Yes
Drew, C.	Safe, but better without gl.	Yes	OD 20/20, OS 20/40	6 mos.		Yes
Dunane, Alexander	Yes	Yes	20/40	6 mos.	Very rarely	Yes
Dudley, W. H.	Yes	Yes	20/30	Yearly	1 in 500	Yes
Dufour, C. R.	Yes	Yes	20/40	6 mos.	Very small	Yes
Dunn, Ira J.	Yes	Yes	6/9	6 mos. for few times; if no change, yearly	2%	Yes
Dunn, Jas. W.	Yes	Yes	15/30 both eyes	Yearly in pres- byopes	5/10%	Yes
Easton, Elwood T.	Yes	Yes	20/40	6 mos.	O+ with rims	Yes
Eaton, F. B.	Generally yes	Yes	2/3	Yearly	1/10 of 1%	See Remarks
Edwards, J. A. Oculist and Aurist to L. & N. R. R. Co.	Yes	Yes	20/40	6 mos.	Cannot tell	Yes
Ellegood, J. A.	Yes	Yes	6/12	2nd exam. 3 mos. 3rd in 6 mos. afterwards yrly.	1/10 of 1%	Yes
Ellett, C. E.	Yes	No		Yearly	1/10%	Yes
Ellis, H. Bert	Yes	No		6 mos.	1/10%	Yes



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 Remarks.
 

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I have yet to see a pair of rimmed specs that have been broken while on the wearer's face. It is my opinion, and we put your first section in practice on the L. & N. R. R. At present the road does not specify as to re-examination, but should do so.

Firemen requiring glasses should not be promoted to enginemen.

Depending entirely upon a man's habits; a man who used alcohol and tobacco should be examined monthly; a strictly temperance man, six months. The additional experience and caution acquired with advancing years would more than compensate for the loss in V., provided it could be brought to normal.

This is an exceedingly grave question and one which merits our most thoughtful consideration. The frequent and terrible railroad accidents which afflict this country are a cause for national sorrow and shame. It is imperative that every restriction should be thrown around men upon whom such weighty responsibility rests. When we reflect that a train traveling at the rate of 60 miles an hour covers almost 90 ft. in one second of time, we can appreciate why a man's vision should be at once quick and accurate. There are so many factors that cannot be encompassed by rules that a great deal should be left to the intelligent judgment of the examiner; for instance: two men may have a recorded vision of 20/20, but one will pick out the letters quickly, accurately and confidently, while the other will get them slowly, laboriously, and uncertainly. The reason I suggest 20/50 as the minimum vision an employe should possess is that I do not think an employe should be retained in a highly responsible position whose vision is so poor that he is absolutely helpless without his glasses. It is a matter of great importance to the country that a scientific standard should be worked out whereby the vision of railroad employes may be fairly judged.

The tests should be practical tests on work, not in office; past record should be taken into a/c.

Would suggest the engineer or employe be required to use glasses with rims, and if he have second pair available I see no necessity for a minimum standard.

I should say 20/40, or in case of exceptionally good and reliable employes, 20/50. This would depend somewhat on condition causing poor sight, for example: Astigmatism causing poor sight may cause monocular diplopia, particularly when looking at a small light, such as would represent a railroad signal. Such diplopia might occasion more confusion and risk of disaster than would the blurring due to a simple myopia.

About 20/40 in presbyopes. Aged 30 to 35 about 20/30; under 30 about 20/20.

Yes, excepting when engineer of passenger is with only one fireman or engineman in cab. (Late oculist to U. P. R. R. & Ore. and Nav. Co.)

I hope you will pardon me for calling to your attention cases of normal vision in one eye and subnormal vision (even after correction of errors of refraction) in the other occurring in old employes.

Name.	Question I.	Question II.	Question III.	Question IV.	Question V.	Question VI.
Elwood, Calvin R.	Yes	Yes	20/40	Yearly	26%	I can
Engle, H. P.	Yes	Yes	20/80	6 mos.	.001%	Yes
Erwin, A. J.	Yes	Yes	10/20	Yearly	1%	Yes
Evans, C. L.	Yes	Yes	20/40	6 mos.	5%	Yes
Ewing, U. B. G.	Yes	Yes	Difficult to fix upon	6 mos.	2 or 3%	Yes
Faith, Thos.	Yes	Yes	20/80	Yearly	1%	Yes
Ferris, E. S.	Yes	Yes	6/9	6 to 12 mos.	5%	Yes
Fish, H. M.	Yes		20/100	Yearly		See Remarks
Fisher, Herschel	Yes	No ?	10/20?	6 mos.	2%	Yes
Fisher, W. A.	Yes			3 mos.	Hardly any	Yes
Fitch, W. H.	Yes		20/40	6 mos.	1%	Yes
Fletcher, E. L.	Yes	6/6	Normal 6/6	6 mos.	1/10 of 1%	Yes
Franchere, F. E.	Yes	Yes	6/9	Yearly	1/10%	Yes
Frankhauser, F. W.	Yes	Yes	20/40	2 years	1%	Yes
Friebis, Geo.	Yes	Yes	Your standard	6 mos.	Cannot say	I can and do
Friedmann, Arthur C. H.	Yes	Yes	5/20 - 5/25	Yearly	Less than 1%	Yes
Fridenberg, Percy	Yes	Yes	20/70	6 mos.	0.1%	Yes
Fringer, W. R.	Yes	Yes ?	20/70 ?	6 mos.	1/5 of 1%	Yes
Gamble, W. E.	Yes	Yes	20/40	Yearly	Fraction of 1%	Yes
Gardiner, E. J.		Yes	20/50	Quarterly	1/2 of 1%	I do
Garten, M. H.	Yes	Yes	25%	6 mos.	1% or less	Yes
Getz, H. L.	Depends on duties	Yes	20/40	Yearly	Don't know	Yes
Gibbons, Edw. E.	Yes	Yes	20/30	6 to 12 mos.	Very few	Yes
Gifford, H.	Yes	Yes	20/30 both eyes together	2 yrs.	A negligible quantity	Yes
Gillette, P. F.	Yes	Yes	6/12	6 mos.		Yes
Gillman, R. H. W.	Yes	Yes	20/60	Yearly	1/4%	Yes
Goldsmith, Perry G.	Yes	Yes	6/18	6 mos.	2% ?	Yes
Goldberg, Harold G.	Yes	Yes	6/8 one eye, other 6/15	Yearly	5% ?	Yes
Gorham, Geo. H.	Yes	Yes	20/50	6 to 12 mos.	1%	Yes
Gould, Geo. W.	Yes	No		2 yrs.	Extremely small	Yes
Gradle, H.	Yes	Yes	20/50 both eyes	2 yrs.	Very small	Yes
Grant, Harry Y.	Yes			6 mos.		Yes
Grant, J. G.	Yes	Yes	20/30	Yearly	5%	Yes
Greene, D. W.	Yes	Yes	1/2		2% ?	Yes
Greenwood, Allen	Yes	No	Would depend entirely on cause of failing V.	Yearly	Very small	Yes
Griffin, O. V.	Yes	Yes	20/40	Yearly if tested under cycloplegic	5% ?	Yes
Griffith, M.	Yes			6 mos.	1% ?	Yes
Grove, Benj. H.	Yes	Yes	20/60	Yearly	1/2 of 1%	Yes
Grove, W. F.	Yes	Yes	20/40	6 mos.	2 to 5%	Yes
Guilford, Paul	Yes	Yes	20/30 & 20/40	6 mos.	Rare	Yes
Guttman, J.	Yes	Yes	20/30	6 mos.		Yes
Hager, W. A.	Yes	Yes	6/9	Yearly	Very small	Yes
Hagler, Elmer E.	Yes	Yes		Yearly up to 50, then ev. 2 yrs.		Yes
Hagler, Arthur L.	Yes	Yes	20/20	Annually	2%	Yes
Harlan, Herbert	Yes	Yes	20/40	Yearly	Very few	Yes
Hale, Albert B.	Yes	Yes	6/9	6 mos.	Very seldom	Yes
Hale, Geo. W.	Yes	Yes		Yearly	None	Yes
Hanna, Hugh	Yes	Yes	20/30	6 mos.	2%	Yes
Hansell, Howard F.	Yes	No	No minimum	Yearly	Insignificant	Yes
Hanske, E. A.	Yes	Yes	20/40	6 mos.	None during 5 years	Yes
Harlan, Geo. C.	Yes	Yes	2/3	6 mos.	Rather rare	Yes
Harrison, W. G.	Has had no experience					
Hatch, W. G.	Yes	Yes	20/50	6 mos.	1%	Yes
Heath, F. C.	Yes	Yes	20/40	6 mos.	1/10 of 1%	Yes
Heckel, Edward B.	Yes, if error of ref. is not too great	Yes	Greatest ref. error should not be over 3 or 4 D.	6 mos.	.01%	Yes
Henderson, F. L.	Yes	No	See Remarks	Yearly	No record	Yes

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 Remarks.
 

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I would suggest that sometimes the medical examiner is a little bit hasty or arbitrary and that an injustice is done the applicant for the engine. I do not care how rigid the examination is for the fireman, but if he has served a satisfactory apprenticeship and his time comes for promotion, it seems a gross injustice, which sometimes blights a young man's prospects, to be rejected when his eyes are in the same condition they were when he made his first application.

One of my patrons who has been a passenger engineer for at least 15 yrs. on the Penna. Lines (been with them as an engineer for over 19 yrs.) and has an unusually good record for small number of accidents, has a visual acuity of O. D. 15/120+O. S. 15/160+, corrected with O. D. + 3.50 combined +3.00, 95°, O. S. +4.00 comb. +1.50 75°, V.=15/20 and 15/15.

Yes, with possible exception of so frequent re-examination in certain cases.

It seems to me that the protection which the glasses afford the eyes from wind and dirt will be more than a balance for the dirt that must necessarily accumulate upon the glasses from dust and dirty fingers, etc.

II and III cannot be fixed. Most diminution is on account of hypermetropia or astigmatism in these men. still a myopia of 3 or more D. might be possible, and if a correction gives perfect vision, or the required standard, such a condition should not exclude an employee.

The Boston and Maine give an examination to all their men once in 2 yrs., sometimes oftener. They never promote a fireman if he is obliged to wear glasses to bring his vision up to normal, but will allow him to retain his position. Until recently they did not allow the engineers to do so; now they do. I personally think that is perfectly safe and just as well.

Myopia of over 4 D. ought to incapacitate.

As long as the low V. is entirely dependent upon an error in refraction, which glasses correct, no minimum is needed.

Name.	Question I.	Question II.	Question III.	Question IV.	Question V.	Question VI.
Herbert, J. Fred.	Emphatically yes	Yes, 75%	See Remarks	Yearly	1/10 of 1%	Positively
Herron, J. T.	Yes	Yes	1/2 or less	6 mos.	Very small %	Yes
Hess, Wm. L.	Yes	Yes	20/30	6 mos.	None in 5 yrs.	Yes
Hawley, Clark W.	Only on branch lines, not on mail or fast lines	Yes	20/30 to 20/40	Below 40, 5 yrs.; above 40, 2 yrs.		As above mod- ified as to main lines
Holmes, C. R.	Yes, if ref. error is of moderate degree	See Remarks	See ans. No. 2	6 mos.	Very, very small	Yes, limited by ans. No. 1 & 2
Holmes, Geo. J.	Yes	Yes	20/20 in one eye at least for ex- press and pas- senger trains	6 mos.	Very small	Yes, fully
Holt, E. E.	Yes	Yes	0.7	Yearly at least	Less than 1%	Yes
Hood, T. C.	Yes	No	See Remarks	6 mos.	5%	Yes
Hoople, Heber N.	Yes	Yes	2/10 or 3/10	Yearly	1 1/2%	Yes
Hopkins, E. K.	Yes	Yes	20/70	6 mos.	25%	Yes
Howe, Lucien	Depends on de- gree V. is below required stand.	Yes	Not below 6/10 in one	Yearly	Difficult to say	Not unless word "below" is qual- ified properly
Hubbell, Alvin A. Oculist L.S. & M.S. R.R.	Yes	No		Yearly	Very small	Yes
Hughes, M. A.	Yes	Yes	5/6	4 mos.	1 in 200	Yes
Hulen, Vard H.	Yes— See Remarks	Yes	20/40 both eyes open	6 mos.	1 in 500	Yes
Hunter, D. W.	See Remarks	Yes	20/50	Yearly	Not worth con- sidering	Yes
Jack, Edwin E.	Yes	Yes	5/12 each eye	6 mos.	1/5%	Yes
Jackson, Edward	Yes	Yes	20/100	3 yrs.	.005% or less	Yes
James, J. H.	Yes	Yes	20/70	Yearly	2%	Yes
Jameson, Geo. C.	Yes	Yes	6/15	6 mos.	5%	Yes
Jamieson, T. H.	Yes	Yes	20/80	Yearly	1 to 1000	Yes
Jennings, J. E.	Yes	Yes	20/30 one; 20/40 other	3 yrs.	1%	Yes
Johnson, Walter B.	Yes	Not if gl. make V. normal	V. sufficiently good for ordi- nary use	Yearly	1/10 of 1%	Yes
Johnston, Richard H.	Yes	No		Yearly	1%	Yes
Jonas, A. F.	I would	Yes	20/20 - 30/30	6 mos. to 2 yrs.	Don't know	I can
Kahn, D. L.	Yes	Yes	20/40	6 mos.	—1%	Yes
Kalish, Richard	I would	Yes	20/40	6 mos.	No %	Yes
Kamerly, Jr., E. F.	Yes	No	No limit with perfect V.	Depends on age and kind of ref.	1/10 of 1%	Yes
Kanne, A. J.	Yes	Yes	5/10	6 mos.	—1/10%	Yes
Keiper, Geo. F.	Yes	Yes	20/40	Yearly	Very few	Yes
Kellogg, Francis B.	Yes	Yes	Roughly, 6/24	6 mos.	1%	Yes
Kelly, B. C.	Yes	Yes	20/30	Yearly	2%	Yes
Kennon, B. R.	Yes	Yes	20/50	Yearly	—1% in rims	Yes
Kierulff, B. F.	Yes	Yes	20/30	6 mos.	1%	Yes
Kilburn, Henry W.	Yes	See Remarks	See Remarks	6 mos.	2%	Yes
Kimble, L. E.	Yes			6 mos.	1% in rims	Yes
King, G. L.	Yes			6 mos.	1 to 500	Yes
Kirkendall, John S.	Yes	+4.D A. or Hy.		Yearly	1 1/2% in rims	Yes
Kirkpatrick, S.	Yes	Yes	20/200	Yearly	—1%	Yes
Kestler, O. F.	Yes	Yes	10/20	6 mos.	—1%	Yes
Klinedinst, J. F.	Yes	Yes	15/30	Yearly	4%	Yes
Knapp, Arnold	Yes	No		Depends on case		Yes, except to the frequency of re-examination
Knapp, Hermann	Yes	Yes	20/30	6 mos.	Don't know	If a perfect field in either eye is required
Kniskern, E. L.	Yes	Yes	20/60	6 mos.	None in rims	Yes
Knox, R. W.	Yes	Yes	1/2 either eye	Yearly	No data	Yes
Koenig, C. J.	Yes	No		6 mos.		Yes

## Remarks

I would not consider any amount, no matter how low, provided the V. could be brought up to normal or nearly to that point.

No standard of V. less than 20/20 secured without glasses or by corrective glasses of moderate strength should be allowed—for instance, a hypermetrope of +1. D. might only have V.=20/40 without correction at 50 yrs. of age. This would be unsafe in an emergency. Other instances of myopia and astigmatism of low degree would readily occur to you where the V. without corrective lenses is surprisingly low.

A railway engineer patient of mine, age 47, is myopic; has without glasses R. V.=9/200; with -3.25 -1.75, 145=20/30. L. V.=20/60; with -1.75 -0.50, 35°=20/30+; service 15 yrs. I consider him a safe man.

If classes fitted by oculist and kept under oculist's observation.

Experience should count against a moderate reduction of V., which can be brought up to standard by glasses.

No man can be counted safe on a railroad that does not encourage its employes to have the best vision they can obtain and to acknowledge their visual defects.

My theory has always been that if glasses bring one's V. up to 20/20, so far as V. is concerned, he is just as good a man as the man who has 20/20 without specs.

It is my opinion that if the vision can be brought up to the required standard by the use of glasses, no minimum standard of diminution of vision is demanded, provided there is no ocular disease.

I think the amount of ametropia is the question at issue, and I can see where an employe could have normal vision and yet have an error that would disqualify him from such positions, for example, I have a patient who sees 20/20 in either eye, whose maximum amount of ametropia is, under atropin, R.+9.00 +4.50, 180°; L.+8.50+5.00, 170°. And I would suggest, regarding the accepting of new employes, that they should be examined by an oculist under a mydriatic in order to know the maximum amount of error, unless they allow the adjustment of glasses to all employes in their service.

Believe the railroads and public will be imperfectly served if old employes are removed because of lowered visual acuity which can be restored to normal with glasses. There is no more danger surely that a pair of rimmed glasses will be broken on an engine than that the engineer should become disabled from some other cause, and certainly a second pair of glasses would instantly remedy the trouble. I would be more inclined to reject myopes than hyperopes.

We do not allow enginemen or firemen on our road to use glasses, but a careful consideration of the matter recently has convinced me that glasses should be allowed.

Name.	Question I.	Question II.	Question III.	Question IV.	Question V.	Question VI.
Kohler, C. H.	Yes	I think so	20/40 in one eye	2 or 3 yrs. after 1 or 26 mos. exam	10% 5 to 10%	Yes
Kollock, Chas. W.	Yes if glass not stronger than +2.00	I think so	20/100	6 mos.		Yes
Krauss, Fred'k	Yes	Yes	5/45	6 mos.	None	Yes
Kress, Palmer J.	Yes	Yes	5/9 one eye, 5/7 other	9 to 12 mos.	—1/2% in rims	Yes
Kyle, John J.	Yes	Yes	20/60	Yearly	?	Yes
LaCrone, O. A.	Yes	Yes	20/70	Yearly	1%	Yes
Lamb, F. W.	Yes	Yes	20/40 or 20/50	6 mos.	—1%	Yes
Lamb, R. S.	Yes	Yes	6/9 one eye, 6/7.5 other	6 mos.	1/2 of 1%	Yes
Lancaster, Walter B.	Yes					
Lapsley, R. M.	Yes	Would require consideration of individual cases		Yearly	1%	Yes
Large, S. H.	Yes	See Remarks		6 mos.	?	Yes
Lauder, Edw.	Yes, conditionally and conservatively	Yes	See Remarks	Yearly	1/2 of 1%	I certainly can
Leenheer, C. A.	Yes	Yes	20/30	Yearly	1%	Yes
LeFever, C. W.	Yes	Not if gl. give normal V.	No minimum	Yearly	1/5%	Yes
Leicht, Oswald	Yes	Yes	20/30	Yearly	Rare	Yes
Lemere, Henry B.	Yes	Yes	20/40 both eyes	See Remarks	Nil in R.R. work	Yes
Leopold, Isaac	Yes	Yes	6/9	Yearly	1%	Yes
Lewis, J. D.	Yes	Yes	?	Yearly	Very few	
Lewis, G. Griffin	Yes	Yes	20/30	6 mos.	—1/10 of 1%	Yes
Lippincott, J. A.	Yes	Yes		6 mos.	10%	Yes
Lucid, M. M.	Yes	Yes	6/9	3 mos.	2%	Yes
Ludewig, W. H.	Yes	Yes	6/9	6 mos.	1/2%	Yes
Lukens, Chas.	Yes	No		6 to 12 mos.	—1% in rims	Yes
Macleish, A. L.	No experience					
Mahoney, G. W.	I would	Yes	20/40	Yearly	1/2 of 1%	Yes
Manchester, A. E.	See Remarks	See Remarks	See Remarks	See Remarks		
Supt. Motive Power C. M. & St. P. R. R.						
Mann, Wm. A.	Yes	Yes	?	Yearly	1 to 1000 in rims	Yes
Marbourg, E. M.	Yes	Yes	20/50 one eye, 20/40 other	6 mos.	1%	Yes
Marlow, F. W.	Yes	Yes	6/18	Yearly	1%	
Martin, H. H.	Yes	Yes	20/20	Yearly	No idea	Yes
Martin, W. C.	No experience					
Masters, J. L.	Yes	Yes	20/30	Yearly	See Remarks	Yes
May, Chas. H.	Yes	Yes	20/30	3 mos.	Few	Yes
McConachie, A. D.	Yes	No	Any V. brought to normal by gl.	Yearly	Cannot guess	Yes
McCoy, Thos. J.	Yes	Yes	20/40	1 or 2 yrs.	1 in 500	Yes
McDavitt, Thos.	Yes	Yes	20/30	Yearly below 50; 2 yrs. above 50	1%;	Yes

## Remarks.

Don't see how you could fix a standard, as age and different kinds of errors of A. would have to be considered.

Assuming this to mean for fast passenger service, (excluding freight and yard men), I consider a minimum of 20/40 low enough.

I find a large percentage of old enginemen need glasses, and many do wear them when not in danger of being caught. I should go a step farther than you suggest, and permit men with normal V. to wear plain lenses on windy and dust blowing days. How any man can be expected to see when his eyes are constantly streaming tears is beyond me.

Every two years if primary exam. is with cycloplegic. Would suggest that exceptionally strong frames and heavy lenses be used.

Q. 1. That I believe the Railroad Company should continue a man in the line of service in which he is employed,—if on examination or re-examination it is found that his eyesight can be made fully normal so far as strength of V. is concerned and under the other conditions as stated in your inquiry.

Q. 2. I do not think there should be a minimum standard. If the glasses will not bring the eyesight to normal, I would not favor continuing the man in such service.

Q. 3. I would not promote a man into a line of service, such as from fireman to an engineer, on whom it was necessary to put glasses in order to pass the requirements of vision.

Q. 4. From my own personal observations I would say that once a year is sufficiently often for the re-examination, that is where the cause for the re-examination is only the advanced age. After a man has suffered in accident or in severe fit of sickness, it would be well in each case to have such a man examined before they are returned to service, but if the examination is only to take care of the advancing years and the natural depreciation of the eyesight during that time, I believe once a year is as much as is necessary. My personal belief is that a man with properly fitted glasses which bring his eyesight to normal, sees as well, or better, than the man who does not use glasses; his eyes are protected from the wind, and the dust and smoke, and are less liable to run tears from such exposure than the eyes of a man whose eyesight is fully normal, but exposed to the conditions as stated above. The worst trouble is in connection with legal complications. There is a general feeling that a man wearing glasses has not as good general eyesight as one who sees without glasses, and in case of accident lawyers take advantage of every point of this kind and make it embarrassing and sometimes expensive to the company unjustly. The one thing that will overcome this feature will be that conventions of oculists and men who are expert in this calling will take the position that a man's eyesight is as good, or better, when the man is provided with glasses that bring his eyesight to normal, than is a man without them. If this cannot be done, there is always a question of hazard to the company in having men in service who wear glasses.

In examining railroad men have often felt that a grave injustice is done to them in accepting them with a static refraction of such a kind that by the time middle age is reached the visual acuity must fall below the required standard, i. e., cases of a high degree of hypermetropia or hypermetropic astigmatism. Consequently it has seemed to me desirable to take into consideration, not only what the V. is at the time of examination, but also what the static refraction is, and therefore what the V. will be when the man is between 40 and 50 years of age. Unless the use of glasses is unconditionally permitted, this seems to me a very important matter.

If closely corrected and fundus is normal, once in twelve months.

Name.	Question I.	Question II.	Question III.	Question IV.	Question V.	Question VI.
McIntire, Chas.	Yes	Yes				Yes
McKay, R. J.	Yes	Yes	1/3	Yearly	Few	Yes
McKimmie, O. A.	Yes	Yes	5/9	6 mos.	% small	Yes
McReynolds, J. W.	Yes	Yes	Depends on form of ametropia	6 mos.	Don't know	Yes
Oculist T. & P. Ry., G. C. & S. F. Ry., Tex. Mid. Ry.			20/20 one, 20/30 other	6 mos.	—1/10 of 1%	Yes
Means, C. S.	Yes	Yes	M. 20/40, H. 20/60	Yearly	1/5 of 1%	Yes
Merrill, W. H.	Yes	Yes	20/20	6 mos.	5%	Yes
Meyer, J. H. Wm.	Yes	Yes				Yes
Surg. L. S. & M. S. R. R.						
Miles, Henry S.	Yes	Not if gl. give normal V.		Annually	1/10%	Yes
Miller, H. G.	Yes	Yes	20/40		1/10 of 1%	Yes
Miller, Robt. W.	Yes	Yes	20/25	6 mos.	—10%	Yes, if man is not too old and a 1st class engineer
Millikin, B. L.	Yes, if standard is normal V.	Yes	6/6	6 mos.	Very small	Yes
Minor, C. L.	Yes	Yes	20/40	6 mos.	Rare	Yes
Oculist Detroit Southern						
Minor, J. L.	Yes	Yes	20/20	Yearly	Rare	Yes
Mitchell, S.	Yes	Yes	20/40	6 mos.	1/20 of 1%	Yes
Mittendorf, Wm. F.	Yes	Yes	?	Yearly	1%	Yes
Moffett, H. C.	Yes	Yes	20/40	Yearly	— .005	Yes
Montgomery, W. T.	Yes	Yes	20/40	Yearly	1/10 of 1%	Yes
Moore, O. C.	Yes	Yes	6/12	6 mos.	1 to 1000	Yes
Moore, T. W.	Yes	Yes	20/80	Yearly	2%	Yes
Moraweck, E.	Yes	Yes	20/40	6 to 12 mos.	—5%	Yes
Morrison, Frank A.	Yes	Yes	10/20	Yearly	Rare	Yes
Morrow, Ed. P.	Yes	Yes	20/100	Yearly	Almost none	Yes
Moss, R. E.	Yes	Yes	20/50	6 mos.	1%	Yes
Mott, J. S.	Yes	Yes	20/30	Yearly	2%	Yes
Moulton, H.	Yes	Yes	1/4	Yearly	5/10%	Yes
Muncaster, S. B.	Yes	Yes	6/9 or 6/12 and 6/6	6 mos.	5%	Yes
Munson, G. S.	Yes	Yes	20/40 and 20/50	6 mos.	Rare	Yes
Murphy, F. G.	Yes	Yes	20/20 and 20/30	3 mos.	—1%	Yes
Norton, C. E.	Yes	Yes	20/30	4 mos.	5%	Yes
Noyes, G. L.	Yes	Yes	?	6 mos.	Rare	Yes, fully
Oldham, J. Y.	Yes	See Remarks	See Remarks	6 mos.	Rare	Yes
Owens, John E.	See Remarks					
Chief Surg. C. & N. W. R. R.						
Park, J. Walter	Yes	Yes	20/200	6 mos.	Very rare	Yes
Parker, E. F.	Yes	Yes	?	Yearly	1%	Yes
Patterson, J. A.	Yes	Yes	6/9	Yearly	—1/10%	Yes
Oculist Col. Mid. Ry.						
Patterson, J. M.	Yes	No		Yearly	—1/10 of 1%	Yes
Patterson, M. F.	Yes	Yes	20/50	6 mos.	1/5%	Yes
Patton, Chas.	See Remarks	Yes	20/30	6 mos. to 1 yr.	1%	See Remarks
Payne, C. W.	Yes	Yes	20/60	Yearly	—1%	Yes
Payne, C. S.	Yes	No—Remarks		6 mos.	1/2 of 1%	Yes
Payne, S. M.	Yes	Yes	20/20	6 mos.	—1 in 1000	Yes
Pearson, Wm. W.	Yes	Yes	20/40	Yearly	?	Yes
Peck, W. H.	Yes	No	Unimportant if gl. give normal V.	Yearly	—1%	Yes
Pfingst, Adolph O.	Yes	No	See Remarks	3 to 4 yrs.	?	Yes
Peters, W. H.	Yes	Yes	20/100	6 mos.	10%	Yes
Petermann, H. E.	Yes	Yes	20/20 and 20/40	6 mos.	Very small	Yes
Pinckard, C. P.	Yes	No	None	6 mos.	1/10%	Yes
Pischel, Kaspar	No experience					
Plummer, S. C.	See Remarks					
Chief Surg. Rock Is. Sys.						
Pooley, Thos. R.	Yes	Yes	20/30	5 yrs.	?	Yes



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 Remarks.
 

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For new men my opinion is that normal vision for both eyes should be required.

If there are any signs of approaching cataract examine every 6 mos.

While vision may be defective, the engineman may be very expert and skillful. That would more than balance; otherwise should be retired.

So long as his vision can be brought to normal with glasses I would consider him a safe man.

Firemen and brakemen are not eligible for promotion when glasses are required to reach the standard normal vision, and under such circumstances, they are not retained in service; they are given a certain specified time in order to get other employment. Many special examinations of men in the service are made, and in order to be retained, the employee must have 20/30 V. in each eye, or 20/20 in one and 20/40 in the other without glasses, or he may be retained if glasses will bring his visual acuity to this point. There is considerable difference of opinion as to whether men should be examined every three or five years. There are some men in our service who are examined every year. I think that 3 years would be a good average.

I have always advocated that it is not right to discharge a man on account of his diminution of distant vision when he can have normal vision with glasses, but compel him to carry an extra pair or two along.

If muscular balance is good and patient's manifest is not less than 20/30 and lens give a vision of 20/15. Some railroads I think very careless as to vision of employees, and that only a vision with 20/20 each eye, singly, and 20/15 with both eyes should be considered.

No standard; if glasses bring vision up to normal is all that is necessary.

I have contended for years that a great injustice has been done employees by not permitting the use of glasses by officials who were themselves wearing gl. However, I always advise flagmen at crossing should not wear glasses, but should have perfect vision without, so they can see to the side as well as in front, and also prevent danger from snow, rain, or sleet getting on the glasses. It is a very common trick for railroads to hire old, decrepit, half-blind cripples to guard crossings, because they have to take care of disabled employees. It is a case of the blind leading the blind. Men in such a position ought to have all their faculties perfect.

As long as normal vision with glasses, amount of refractive error should not prevent promotion.

I do not feel competent to answer the questions which you ask in your circular, as I have had no practical experience as to the effect on glasses of being in an engine cab, whether the vision becomes blurred by condensation of vapor or by coal smoke or not. I would value your opinion in this direction very highly, because you have probably had more experience in this line than any other ophthalmologist. I am interested to know that you think a man with glasses is a safe employee, because it seems very hard to discharge experienced employees as soon as their vision requires their wearing glasses. In answer to your 2nd question, I would answer yes.

Name.	Question I.	Question II.	Question III.	Question IV.	Question V.	Question VI.
Posey, W. C.	No experience					
Post, M. H.	Yes			Yearly	Almost never	Yes
Prichard, J. M.	Yes	Yes	20/30	6 mos.	10%	Yes
Prefontaine, L. S.	Yes	Yes	20/20 and 20/30	Yearly	Very small	Yes
Pritchard, J. F.	Yes	Yes	20/20 and 20/30	Yearly	See Remarks	Yes
Chief, Surg. Wis. Cen. R. R.						
Prout, J. S.	Yes	Yes	?	?	-1/10%	Yes
Pusey, Brown	Yes					Yes
Pyfer, H. F.	Yes	Yes	6/60	Yearly	1/100%	Yes
Quackenboss, Alex.	Yes	Yes	?	Yearly	Rare	Yes
Quayle, R.	Yes	Yes		Yearly	No idea	Yes
Supt. M.P.C. & N.W.R.R.						
Randall, B. Alex.	Yes	Yes	1/3	6 mos.	1:10,000	Yes
Randolph, R. L.	Yes	Yes	20/40 and 20/30	2 yrs.	5%	Yes
Raub, J. F.	Yes	Yes	20/40	Yearly	-1%	Yes
Ray, J. M.	Yes	Yes	See Remarks	6 mos. to 1 yr.	Very few	
Oculist L. & N. R. R.						
Reamer, E. Frank	Yes	No	20/50	6 mos.	-1%	Yes
Reese, R. G.	Yes	Yes	20/30	Yearly	1/10 of 1%	Yes
Remmen, N.	Yes	Yes	20/40	2 or 3 yrs.	1 in 5000	Yes
Reynolds, Dudley S.	Yes	Yes	6/18	Yearly	1/100%	Yes
Reynolds, J. W.	Yes	Yes	20/50 and 20/30	6 mos.	1/5%	Yes
Ritchie, Stephen O.	Yes	20/20	20/20	6 mos.	Rare	Yes
Ridout, W. J.	Yes	Yes	20/60	6 mos.	1/10 of 1%	Yes
Rinehart, H. W.	Yes	See Remarks	20/40	12 mos.	1/2%	I can
Risley, Sam'l D.	Yes	Yes	6/9	Yearly	Rare	Yes
Roberts, W. H.	Yes	Yes	6/12	Yearly	?	Yes
Robin, E. A.	Yes	Yes	20/40	Yearly	Rare	Yes
Rodman, C. S.	Yes	Yes	See Remarks		?	Yes
Rogers, A. C.	Yes	Yes	20/70	Yearly	1/500	Yes
Rogers, Benj. F.	Yes, +1 D.	Yes	20/30 +1 D.	4 to 6 mos.	1%	Yes
Rogers, W. K.	Generally speak- ing, yes, but per- sonal equation must be counted and a minimum of such eyes should be reach- ed by excluding latent hyper- opes, etc.	Yes	An arbitrary standard should be adopted by trunk lines through mutual agreement on recommendation of expert committees	About once in two years if full correction is worn and acci- dents are treat- ed by company surgeons except myopes	The number is too small to estimate	Yes, with the qualifications added to Ques- tions 1 and 4
Rohrer, Geo. R.	Yes			6 mos.	Small	Yes
Roller, Louis A.	Yes	Yes	20/40	Yearly	-1/2 of 1%	Yes
Roy, Dunbar	Yes	Not arbitrarily fixed	Should vary with individual case	Yearly	?	Yes
Rudgers, D. W.	Yes	Yes	20/40	6 mos to 1 yr.	Very small	Yes
Russell, E. R.	Yes	Yes	20/50	6 mos.	-3%	Yes
Ryan, E. S.	Yes	No	See Remarks	6 mos.	Rare	Yes
Ryan, L. R.	Yes	Yes	20/70	Yearly	1%	Yes
St. John, S. B.	Yes	Yes	20/40	3 yrs.	3 in 20,000	Yes
Sampson, F. E.	Yes	Yes	20/40	See Remarks	-1%	Yes
Samson, W. Stanley	Yes	Yes	20/20	6 mos.	5%	Yes
Sanders, A. F.	Yes	Yes	7/10	Yearly	Very few	Yes
Savage, G. C.	No experience					
Schaefer, Otto	Yes	No		Depends on condition	Very small	Yes
Schild, Edwin H.	Yes	Yes	20/40	Yearly	Very small	Yes
Schweinitz, de, George E.	Yes	The standard should not be below 6/6 or 6/9		Yearly	Rare	Yes

## Remarks.

From my knowledge of refraction and my own experience (H. 1.75 + .50, 90° V. 20/12 either) in driving, bicycling, and driving an automobile (I am almost 54), I am very positive in my opinion that I should answer yes to your 1st question. I did not require glasses for any purpose until I was 40, and I do all above mentioned things with bifocal glasses.

Our standard is 20/20 with both eyes for all men coming into the service, and approximately that when glasses are required. Anything less debars them from train service. In cases of doubt, which happens only occasionally, there is change made in occupation. Two pairs of glasses are required in case of accident. He is still likely to be provided. All diseased conditions debar him from service.

Depending on his age; if over 45, 20/50; if under 45, 20/30.

Yes and no. Consistent with Question 1, and vision brought to 20/20, then no.

R. R. Cos. should pay for expert advice and make their rules.

In general terms our plan on this division (S. W. System of the Penna. R. R.) has been to retain old employes, that is, the class which you describe, who have been at least five years in service, provided their acuity conforms to the required standard by aid of glasses. In this connection, however, it should be borne in mind that the policy in accepting new employes is to require practically normal vision, without glasses, which in the course of time must nearly eliminate defective acuteness in the older employes, excepting in those where the well marked latent hypermetropic error exists, and even some of these may be eliminated during preliminary examination. Without this feature, I am not sure that I would consider it a safe rule to retain even old employes unless of exceptional character and experience whose visual minimum was low. Again, the position of the employe must be considered; an engine driver has need of visual maximum much in excess of any other operative on the train, and where promotion has this position in view a higher standard should be required than for other places. It is, I think, a distinct disadvantage for a man in this position to be required to wear glasses, and I am reasonably satisfied that they possess an average working acuteness without glasses which is more serviceable with vision of 6/10 to 6/13 than with glasses which would in a consultation room give vision of 6/6. Furthermore, while the minimum standard is advisable in general terms, the personal equation, as I have mentioned under Question 1, must account for a great deal. An engine driver of 15 or 20 years of experience is usually a much safer man with a considerable error of refraction, corrected by glasses giving from 6/10 to 6/6 vision, with all their disadvantages, than one of 4 or 5 years of service. A man who is tried out and is known to possess grit, discretion and presence of mind cannot be readily classified, and while the surgeon adhering to the letter of a fixed standard would be obliged to report adversely upon his visual qualifications, his personal characteristics are too rare to allow this to be an arbitrary bar to his employment. Regarding the minimum standard of vision to be allowed, it seems to me that, as I have said in answer to the Question, it can only be established by a more or less arbitrary decision, which I should think could best be reached by the Railroad authorities themselves,—the various Trunk lines acting in conjunction,—upon the recommendation made by a committee or committees, to be made up of their various oculists.

No limit necessary if vision can be brought up to normal.

The only danger I see in such cases is the possibility of the glasses becoming covered with oil or steam, and the vision blurred in consequence of it. In cold weather on entering the cab the glasses will invariably become steamed.

Depending on patient's age, cause of defect, the time would vary. The 6 mos. period is good as a conventional period.

I am very much of the opinion that employes should be allowed to use glasses when it is necessary under the conditions which you describe. It would be very absurd if they were ruled out. Commandants of battle ships, officers in all of the civilized armies of the world, and officers on Trans-Atlantic liners,

Name.	Question I.	Question II.	Question III.	Question IV.	Question V.	Question VI.
Schutz, M. H.	Yes	Yes	10/50	Yearly	$\frac{1}{2}$ of 1%	Emphatically
Schwenk, P. N. K.	Yes	Yes	2/3	Yearly	-1%	Yes
Seabrook, H. H.	Yes, unless V. is below 20/50	Yes	20/50	6 mos.	-1%	Yes
Seaman, G. E.	Yes	Yes	20/50	6 mos.	Rare	Yes
Sells, F. W.	Yes	Yes	6/6 with gl.	6 mos.	2%	Yes
Shaw, H. L.	No experience					
Shorter, J. H.	Yes	Yes	20/30	4 mos.	-1%	Yes
Skeel, Frank D.	Yes	Yes	20/40	6 mos.	-1%	Yes
Smith, F. A.	Yes	Yes	20/100	2 yrs.	None	Yes
Smith, F. K.	Yes	Yes	?	Yearly	1 in 5000	Yes
Snell, Simeon	Yes	Yes	?	6 mos. to 1 yr.	Very small	Yes
Snyder, Walter H.	Yes, I know men who wear them for protection from dirt, cinders, etc.	Yes, but it must be carefully stated	I suggest only one eye <i>must</i> be 20/50, other not less than 20/80	Every yr., at no expense to the employee	$\frac{1}{2}$ % or less; very small number	Yes, but experience might cause me to verify it more fully
Oculist Wabash Ry.						
Spalding, F. M.	Yes	Yes	20/20	6 mos.	Very small	Yes
Spalding, Jas. A.	Yes	Yes	20/50	6 mos.	None	Yes
Spencer, J. H.	Yes	Yes	20/30	3 mos.	Almost nil	Yes
Spohn, Geo. W.	Yes	Yes	20/30	Yearly	1%	Yes
Starr, Elmer G.	Yes	Yes	20/40	1 $\frac{1}{2}$ yrs.		Yes
Standish, Myles	Yes			Yearly	Rare	Yes
Starkey, Horace M.	Yes	No fixed rule	No fixed rule	Yearly	Rare	Yes
Steele, Henry D.	Yes	Yes	20/40 - 20/50	6 mos.	Rare	Yes
Stevens, C. L.	Yes	Yes	20/30		Rare	Yes
Stevenson, Mark D.	Yes	Yes	1/3	6 to 12 mo.	-1%	Yes
Stevenson Bros.	Yes	Not if gl. correct V.	With 2 pr. gl., let it be ever so great	6 mos.	2%	Yes
Stillson, Hamilton	Yes				1/10%	Yes
Stockwell, C. D.	Yes	Yes	6/12	6 mos.	$\frac{1}{2}$ of 1%	Yes
Strawbridge, Geo.	Yes	Yes	2/3	Yearly		Yes
Stuart, C. C.	Yes	Yes	6/12	6 mos. - glasses seen oftener	-1%	Yes
Stucky, J. A.	Yes	Yes	20/30	Yearly	$\frac{1}{4}$ %	Yes
Stueber, F. G.	See Remarks	By all means	20/30	6 to 12 mos.	Seldom	I can
Stricker, Lonis	Yes	Yes	6/9	6 to 12 mos.	10%	Yes
Sturdevant, J. R.	Yes	Yes	15/20	6 to 12 mos.	1%	I can
Suker, Geo. A.	Yes	Yes	See Remarks	6 to 9 mos.	Rare	Yes
Sutphen, T. Y.	Yes		20/20 binoc.	12 mos.	?	
Swan, C. J.	Yes	Yes	20/40 to 20/50	Yearly	15 of 1%	Yes
Taylor, L. H.	Yes	See Remarks	See Remarks	Yearly	Rare	Yes
Tiffany, Flavel B.	Yes	Yes	20/40	4 mos.	1/10 of 1%	Yes
Thomas, Chas M.	Yes	No		6 mos.	1 - 1000	Yes
Thomson, Edgar S	Yes	Yes	20/100	6 mos.	1%	Yes
Thompson, E. H.	Yes	Yes	20/200	Yearly	10%	Yes

## Remarks.

all use glasses when it is necessary. The question in regard to the minimum standard of diminution of vision are more difficult to answer. Personally, it seems to me that glasses, if worn, should always give the patient at least 20/20 in one eye and 20/30 in the other, as tested in the room of the ophthalmic surgeon or examiner, because I need not point out to you that glasses which give a visual acuity of 20/20 in a room do not give an equivalent visual acuity of 20/20 when used at very long ranges, particularly under certain climatic conditions, and therefore the standard should not be allowed to fall much below the 20/20 test. Perhaps it would be better not to have any minimum standard of diminution, but patients be required to have full visual acuity, either with or without glasses. It seems to me there is a good deal of value in Oliver's suggestion that a good many of these tests ought to be made at very long ranges with suitable enlargement of the test objects. I think, however, that what you have said in regard to increasing the value of the employee, by increasing his visual power with glasses, is certainly important.

Amber glass not only cuts off the chemical rays, but the ultra violet rays as well. There is no doubt about the increase in vision, although I have found no difference by the test types with corrected refraction. It has been claimed for amber yellow shooting glasses that vision is better in fog or rain. Golden yellow shooting glasses are used in India, especially for twilight shooting, and were suggested years before last in England for night blindness. Personally I have not found such effects, although yellow cuts off less light rays than any other glass. Gall and Lembke handed me an anti-sweat (Lacin) pencil a while ago which protects glasses from moisture. With corrections in yellow, and such protection from wet, it would seem as though certain valuable engineers might be saved to the railroad service.

It is practically IMPOSSIBLE to get a great number of engineers who have perfect vision at the age they usually are when they get fast runs, and we prefer to have an oculist fit them to an optician. With the good offices of Dr. Wm. Thompson I put a man back whom the Supt. thought hardly safe. These superintendents do not recognize how few engineers have emmetropic eyes, although they see 20/20, but they have astigmatism and hyperopia, and I prefer to ride behind one of my engineers with 20/20 and a carefully fitted pair of glasses, than a man with the same error uncorrected and straining his eyes with a pair of some optician's glasses. We re-examine a man when he is reported as having run by a signal. Last year I suggested at our annual surgeons' meeting a re-examination of all our men before the Fair at St. Louis. This was done and not an accident was caused by poor eyesight. Engineers on fast runs should be examined every year at the longest, I think.

All lenses are liable to blur in frosty weather from change of temperature; opening of furnace door will occasionally throw out hot air, which will condense on spectacles of engineers for a short time. If the wearers are careful about this, as well as about leaving engine and going into the warm station rooms, I see no risk in their wearing spectacles for the hypermetropia or astigmatism of advancing years.

While not desirable, ought to be continued in service. Just wish to cite the case of an engineer, whose V. without glasses is very low, with glasses about 20/30, yet he has told me that he rarely uses the glasses and does not like to wear them. I enquired, "How does it happen that you having a fast run, have never had trouble?" "Am exceedingly cautious, watch the time, etc." Certainly this man is of more than ordinary intelligence, excellent judgment, sober in the fullest sense, has been my patient for years, yet the facts are as stated.

It has always seems to me to be a great injustice to turn a man down simply because his accommodation needs supplementing. I would further say that, at least 00 eye in rims should be used, 000 better, and in presbyopes the depressed bifocals should be designated as reducing confusion to a minimum.

If vision in either eye can be brought up to 6/7, it matters not what his vision is without glasses. Vision of 6/15, with or without glasses, should debar promotion of any kind.

Not if glasses raises vision to the required standard. No matter what the vision if glasses bring it to the standard, I should regard him safe.

Name.	Question I.	Question II.	Question III.	Question IV.	Question V.	Question VI.
Thompson, J. L.	Yes		20/50	Yearly		Yes
Thorington, Jas.	Yes	No		6 mos. to 2 yrs.	1%	Yes
Todd, Frank C.	Yes	Yes		Yearly	1 in 2000	Yes
Valk, Francis	Yes	Yes	20/20	Yearly	Very small	Yes
Van Benschoten, G. W.	Yes	Yes	20/40	Yearly	5/10 of 1%	Yes
Veasey, C. A.	Not if V. less than 20/30	Yes	20/20—no gl. should be permitted	4 to 6 mos.	?	See Remarks
Voorhies, A. II.	Yes	Yes	1/3	Yearly	—1/10 of 1%	Yes
Voorhees, Sherman	Yes	Yes	20/30	Yearly	10%	Yes
Wadsworth, O. T.	Yes	Yes		6 mos.	Very few	Yes
Waite, F. L.	Yes	Yes	20/100	2 yrs.	Very small	Yes
Warfield, Clarence	Yes	Yes	20/40	Yearly	1%	Yes
Oculist I. G. A. R. R.						
Warren, J. N.	Yes	Yes		6 mos.	Rare	Yes
Railroad Surgeon						
Webster, David	Yes	Yes	20/40	6 mos.	1 in 1000	Yes
Weeks, J. E.	Yes	No		Yearly	1/10%	Yes
Wells, David W.	Yes	Yes	1/10	6 mos.	1%	Yes
Welsh, D. Emmett	Yes	Yes	6/6 and 2/3	Yearly	1/4 of 1%	Yes
Wescott, Cassius	Yes	Yes	6/15	Yearly	Very small	Yes
White, J. A.	Yes	Yes	20/20 with gl.	Yearly	?	Yes
Whitledge, G. A.	Yes	Yes	20/60	6 mos.	Very small	Yes
Wilbur, E. P.	Yes	Yes	20/200	6 mos. to 1 yr.	Very small	Yes
Whitney, Geo. W.	Yes	Yes	20/40	6 mos.	1 in 10,000	Yes
Willets, Jos. E.	Yes	Yes, about 3 D.	See Remarks	6 to 8 mos.	Very small	Yes
Wilkinson, Osear	Yes	Yes	6/12 and 6/18	6 mos.	1/10 of 1%	Yes
Williams, Chas. II.	See Remarks					
Wilmer, W. H.	Yes	Yes	20/200	Yearly	Small	Yes
Wilson, Norton L.	Yes	No		6 mos.	1/4 of 1%	Yes
Wishart, C. A.	Yes	Yes	20/40	6 mos.	?	Yes
Wood, Casey A.	Yes	Yes	20/200	Yearly	Rare	Yes
Woods, Hiram	Yes	Yes	See Remarks	See Remarks	Small	Yes
Woodruff, Thos. A.	Yes	Yes	20/100	6 mos.	—1%	Yes
Woodruff, H. W.	Yes	Yes	6/60	Yearly	Very few	Yes
Worth, Claud	Yes	Yes	See Remarks	See Remarks	Very few	Yes
Wright, J. W.	Yes	Yes	20/30	Yearly	Very small	Yes
Wurdemann, H. V.	Yes	Yes	20/80 each eye	Yearly	—1%	Yes
Young, H. B.	Probably	Yes	20/40 - 20/50	6 mos. and after 3 in 5 yrs. layoff		In most instances
Zentmayer, W.	Yes				Rare	Yes
Zimmermann, M. W.	Yes	Yes		Yearly	—1%	Yes

## Remarks.

Yes, with the opinion I have expressed, not with yours. Cannot see that it would effect the discussion, as engineers and firemen would be more likely to have glasses broken than people following less strenuous vocations.

I do not believe that we should promote a fireman to a position of an engineer who requires glasses to give him the above acuteness of vision. An engineer who has been in service five years as an engineer should be allowed to continue in service with glasses which give him 20/20 in one eye and 20/30 in the other provided he has at least 20/50 in each eye without glasses. I feel that all trainmen wearing gl. should be examined at least once a year, and if the vision has fallen since the glasses were prescribed, they should be referred to the Company oculist for re-testing.

I require 20/20 for men entering the service, but men that have been in service for a long time 20/40 is all that I require of them. I find a man with 20/40 at night sees infinitely better without glasses than with them, even if the glasses give him 20/20, at least that is my own experience; even with 20/60 he sees somewhat better without glasses at night than he does with a glass that gives him 20/20. I certainly agree with you that an old engineman of several years experience should never lose his position because he requires glasses to restore the normal standard. I find that a man with sharp 20/30 for distance can for all intents and purposes read signals well enough not to run any risks. I think it is a hardship that he should be kept out of promotion for a small defect of this kind. Referring to the matter of a person with 20/40 or 20/60 vision seeing better without glasses at night than in the day, you ask me for an explanation. I cannot give you any. I have been puzzled over the thing for a long time and cannot understand it. First, to start with myself, I have a vision in the right eye of 20/60, in the left of 20/40, simply hyperopia, all of which I have developed since I was 45 yrs. of age, prior to that it was latent. My glasses give me 20/10. Now at night out of doors I see better without my glasses, the darker the place, the better I see without them; where there is bright electric light I see better with the glasses. I read your note last evening, and in walking up town some distance, I took particular pains to test my glasses, and except in the brightly illuminated places, I saw much better without them. Several blocks off I noticed there were some red and white lights to show some street repairs that were going on. My glasses enabled me to see these lights more sharply defined in outline, but no better. Without the glasses they were stellate in appearance. I don't know whether this has any dependence on the pupillary action with or without glasses on. I have investigated it closely and have no theory to advance. At the same time, it is a matter for consideration for enginemen on the railroad.

The minimum diminishment of vision must be that which may be corrected by a lens that does not distort at periphery.

In a statement I sent to the Committee on Safety Appliances of the Amer. Ry. Ass'n last August, the following statement was included. "When on re-examination of employes in class A or B it is found that the acuteness of vision is below the required standard, but can be improved by the use of glasses, sufficiently to enable them to pass, the Company will, at its discretion, on the recommendation of the examining surgeon, and giving due consideration to their service record, etc., allow such old employes to pass the test for such class, provided such defect in vision is not the result of disease of the eye with progressive failure of sight, and such employe must use his glasses while on duty and carry with him an additional pair to use in case of accident. Glasses are allowed in any class for reading test." This is almost the same wording as the rule I drew up for the Interborough Rapid Transit Co. of New York about a year ago, and which has worked well there. The classes A and B, above referred to, include enginemen, firemen, train and yardmen, in fact, all employes where the requirements call for a test of vision without glasses in the original test. It seems to me that a yearly re-examination of such men would be sufficient.

Not less than 20/30-40. These men are very apt to leave off their glasses, and they should possess fair vision without them. It should, I think, depend upon the nature of work, age, nature of ametropia, etc. Yearly examinations would seem the safest.

He should, I think, be able in the event of the glasses being lost, by the exercise of special caution, to safely discharge his duties to the end of the run without them. (4) This should depend upon the nature of the defect. The surgeon who sees the case should decide date of next examination.

## DISCUSSION.

DR. SHERMAN VOORHEES (Elmira, N. Y.): The paper is of great interest to all of us, not only to the traveling public but to a large class of men, many of whom are our patients. I think the method as practiced of examining the railway applicants as enginemen, firemen, etc., is very faulty. I examine a great many for railway service, and after the examination by the train master I find many accepted with  $20/40$  vision in one eye. Most officials are not careful of the examination of applicants, and so I am in accord with what Dr. Black has said, that these examinations should be made by trained oculists and that all applicants should be examined under a mydriatic, and if they are found to have latent strain then that applicant should be rejected. That does away with this question almost entirely, because the older men will not develop it later. I think patients with normal accommodation all say they can see better at night without lenses on than with. I think it would be an injustice to the men long in the service to say their services would be no longer required because of a vision of  $20/40$  in one or both eyes. These men are, in my opinion, safe employees. They know all the road, they have been in the service long, and if the vision is brought up to normal in each eye with glasses, they are safe men. I believe they are not safe employees if the vision falls below  $20/40$  or  $20/50$ , and the safety of the public demands they should not continue in the service. I know a large number of engineers leave off their glasses that know they see better with them on. I know men who take them off in the yard because they do not want to be seen wearing glasses, but after they get out of the yard they put them on because they can see better. I think the idea of amber glasses is good on bright days, but I do not think they would be of service at night. I appreciate Dr. Black's paper very much.

DR. W. R. PARKER (Detroit): I represented the Michigan Central last winter at a meeting held in New York, to which the roads of the New York lines sent oculists and general superintendents. The object of the meeting was to determine the vision standard and hearing for all employees, also methods of examination for color sense. We had great difficulty in determining the minimum vision an applicant



should have, without glasses, and still be retained in the service, if glasses give normal vision. That question provoked an animated discussion and was the most difficult thing we had to settle. The opinions differed from  $\frac{20}{200}$  to  $\frac{20}{30}$ , but it was finally determined that the minimum vision could not be less than  $\frac{30}{40}$  combined, or less than  $\frac{20}{50}$  for either eye. The next question that came up was what to do with the men who had  $\frac{20}{20}$  vision at the age of 20, who when they reach the age of 50 will have not more than  $\frac{20}{200}$ , certainly less than  $\frac{20}{50}$ . It was determined as a practical test, to eliminate all applicants who in the examination not only failed to reach  $\frac{20}{20}$ , but those who did reach  $\frac{20}{20}$  with a plus 1.50 lens. That eliminates the large percentage of latent hyperopias. Since then we have examined 5,000 to 6,000 employees and several hundred applicants. Of the latter, about four per cent. were rejected because able to read the  $\frac{20}{20}$  line with the plus 1.50 lens. These four per cent. are rejected now instead of after being in the service 20 or 30 years, when the vision would go below the required standard because of presbyopia. The original examination was done by oculists. They decided that that was too expensive, and some other scheme would have to be devised. I was given six assistants who were clerks in the office. If tests must be done by others than those specially trained, it seems to me this is a very practical solution. Since that time I have ridden on engines, not as far as Dr. Black, but about 1200 miles. Too much cannot be said for the amber glasses. I have tried them time and time again, by letting experienced firemen who do not have scotoma put them on, and asked them at the end of the run how they liked them, and they say, "I think they are all right; I can see just as good with them as without them." I think that was a good, practical answer, as the work about the engine was not interfered with. The amber glass will not prevent the scotoma entirely, in one unaccustomed to firing, but enough so that vision is not interfered with. It is undoubted that most cases of hyperopias do not see as well at night with the glasses. The reflection of the light that Dr. Black speaks of being the cause, is new to me.

Dr. Black has done much to develop this work, and his papers were often quoted at our meeting in New York.

DR. H. V. WÜRDEMAN (Milwaukee): Can you get enough safe young men with inclinations toward railroading, who have emmetropic, standard or normal eyes, who will not, when they are 40 or 50, be obliged to wear glasses in order to see distinctly at a distance? No, you cannot. Only about ten per cent. of people have nearly normal or standard vision. If a slightly ametropic man 40 or 50 years of age loses his glasses, if he has fair vision, he is probably not incapacitated to run his train, because most men have more than  $15/200$  vision. That is the lowest standard without glasses, because in the best kind of skilled labor we can do our work well when we have only  $1/2$  standard vision. We can do some work if our vision falls no less than  $15/200$ . The commonest kind of labor requires only 5 to 25 per cent. of the standard acuity. Amber glasses at night fall in the same category as glasses for refraction. The night is worse with the amber glass than without.

DR. FREDERICK H. MILLENER (Buffalo, N. Y.): I have heard Dr. Black's very able paper with great pleasure, and I wish to add a thought in reference to the different values of lenses. Nature has provided the human eye and the eye of animals with lenses which freely permit all the rays of light to pass through, from the red end of the spectrum to the ultra violet end. Nature has also formed certain crystals, notably the quartz crystal, which also permits of the passage of the rays of light. Not so with the crown glass lenses of commerce, which very materially obstruct certain of the rays, specifically those at the violet end of the spectrum, and the ultra violet rays. So that it is not strange that with the crown glass lenses thus obstructing a material percentage of the rays one cannot see as clearly or as well as with the quartz crystal lenses. The crown glass lenses do not entirely obstruct the rays, but they do remove the ultra violet ray, which ray is responsible for the tanning which the body receives in sunshine—in other words, it is the chemical or bacteriocidal ray. Another point which I wish to make is, that the quartz crystal lenses do not steam or fog as readily as crown glass lenses do. I have experimented with both lenses of equal power, on a locomotive and in a machine shop, and found that the quartz crystal lenses afforded a far better medium for vision.

I was also greatly interested in the slides presented yesterday by Dr. Casey Wood and his paper on the Fundus of the Mammalian Eye. Perhaps it was not generally noticed that in the eye of all night prowling animals the fundus disclosed very strongly the red, orange and yellow colors, while in the day prowling animals the fundus was of the blue indigo and violet colors. I simply call attention to this fact, and would be glad to hear some one explain the reason for it. It may be due to the lenses, it may be due to the fundus. In any event it is a curious and noticeable distinction.

DR. ALLEMAN (Brooklyn): My theoretical opinion was that the men who did not require glasses were the better engineers, but after my first ride on an engine I was converted. An engineer called my attention to the clouding of the glass in the engine cab. It frequently happened in a storm, and he had to stick his head out of the cab to see, and he carried a pair of goggles for protection. If a cinder strikes the eye, the intense pain disables the engineer just at the moment he wants most to see. The glasses can be protected from clouding from change of temperature by a chemical preparation. Another point, which I think has not been mentioned in this discussion, is the case of a man with perfect vision and lack of muscular balance, such a defect could be responsible for impaired judgment. He could not be competent in an emergency; he would be in a condition of nervous exhaustion that would render instantaneous accommodation impossible. Nothing brings out the symptoms of muscular defects as much as watching moving objects. I cannot look out of a car window for two hours without giddiness, dizziness and discomfort, and we should consider the muscular relation in an examination of engineers.

DR. JACKSON (Denver): I agree with Dr. Würdemann that we can not get enough men who are emmetropic to fill these positions. But even if we could, these men being emmetropic at 20, at 40 or 50 a large proportion will have become hypermetropic and require convex lenses to give them normal vision. The unfavorable effect of the lens at night has been alluded to. The most important cause of this, I think, has not been explained. More than 20 years ago when I commenced to wear lenses my attention was turned to this

impairment of vision by lenses in a dim light, and I have carefully studied it since. The reflection of part of the light has something to do with it, but the dilatation of the pupil is more important. Accurate vision is gotten through the center of the pupil. The large majority of dilated pupils show the margin comparatively myopic. This margin admits much more light than does the central area which gives accurate vision, and for the marginal region the convex lens is a hindrance rather than a help. The difficulty diminishes as the pupil grow smaller with age. Blurring of vision by dim light in people who do not wear glasses might often be lessened by putting on concave lenses. As a practical objection to the wearing of glasses, this should be thrown out. It does not interfere more with the vision of those wearing glasses than those without.

DR. E. B. HECKEL (Pittsburg): I am surprised that the amber glass has not been used more commonly than it has. Sportsmen have been using it for years in shooting contests. These amber glasses are sold in the shops under the name of hunting glasses. The question of seeing better in the dark without lenses is one that has been asked me thousands of times, and I have been in the habit of explaining it to my patients in the following way: The more intense the light is, the more necessary is it for the image to be perfect; we unconsciously demand this. In the dark with a moderately dilated pupil the image is not so distinct, and we unconsciously make an effort to accommodate, which results in an image less distinct and as a rule the removal of the glasses, when the eye is able to produce a more distinct image and results in better vision without glasses. The acetylene and electric head-lights have been referred to. I have made a number of inquiries among enginemen and find that they condemn them. I also have found that enginemen who make very fast runs, prefer to run at night with an ordinary head-light, as they claim they can see more.

DR. RYERSON (Toronto): With reference to the use of glasses by railway men, my experience has been that often they object to the use of them about the yards, but put them on when out of sight and acknowledge they see much better with them. Experience with amber glass is that it increases acuity of vision nearly 30 per cent.

DR. VALK (New York): I want to bring the matter down into rather a practical point, in regard to the present and future. In the first place, as I understand from our railway examiners, you have got to do something in regard to the men now employed. We do not want to throw these men out because they have 1 or 2 D. of hypermetropia. I agree with Dr. Black that these men should be allowed to wear glasses. What is going to be done with men who go into the profession of railroad engineering? A large number of men have 1 D., but they will go through life very easily to 50 or 60 with that degree of hyperopia. My own refraction is about the same and yet I do not use glasses. But for men going into engineering in the future, if they have more than 1 D., stop them at once, but if they have less than 1 D., when they get older they will be perfectly safe.

DR. YOUNG (Burlington): I am the original investigator of this subject, and I believe this has all come out in a report I made before the Chicago Ophthalmologic Society some two years ago and published in the *Annals*. All the points discussed here were in that paper (*Annals*, January, 1904), with the exception of the amber glass. I do not think the question of the wearing of glasses by railroad men is as important as the present discussion would lead us to suppose. Any one who will ride in a cab for 100 miles will find that the protection of the eyes is a serious question, but with railroad men you will have to overcome a great deal of prejudice against men wearing glasses on railway engines, not for their inherent defects, but for the popular feeling against it. You will find there will be a greater disposition on the part of railroad men to reduce the standard of visual acuity for the occupation. Investigation made on the Burlington four years ago demonstrated to me that a man with  $\frac{20}{40}$  or  $\frac{20}{50}$  was capable of seeing any signals at a safe distance. These fast trains have emergency stop-breaks that will stop a 60 miles an hour train in eight or twelve hundred feet. That is less than a quarter of a mile; and semaphores are on a scale of  $\frac{20}{20}$  at one half mile. In making these observations I have had the advantage over other men who have made them, in that I had the age and was therefore in the class of the enginemen. So far as wearing glasses is concerned, I had the

same difficulty with my lenses at night, but since I have passed the limit of age, that difficulty has disappeared and I no longer take my glasses off at night but see with them better. In reducing I used the concave glass as Dr. Jackson has suggested, and thus produced my accommodation. But if you will make your standard not  $\frac{20}{20}$  but  $\frac{20}{40}$  or  $\frac{20}{50}$ , it will not be so important a matter.

DR. LUCIEN HOWE (Buffalo): No matter what standard we have, the American Association of Railways is going to do just what it chooses. They asked me for suggestions and advised a standard as high as possible, but they promptly turned it down. It is perfectly useless to make our theoretical standards and to expect them to conform to them. The only way is to make one comparatively low and then later improve it.

DR. D. T. VAIL (Cincinnati): It is useless and folly for officials to formulate any definite rules for engineers to follow, regarding the wearing of glasses. They will put them on, if required, until they are out of the yards, and then they will take them off if they choose. If the glasses become fogged, they will remove them, no matter what the rules are, and if they can do better with amber glasses they will wear them. They must accept the moral responsibilities of the run and can do better if they have the privilege of doing as they please in the cab; this they will any way.

MR. WM. TUNKE (by invitation): I am an engineer on the Lake Shore road. The invitation was extended to the Chairman of the Board of Adjusters, but he could not be here. I came up and listened on invitation. I have run an engine several years. I wear glasses in order to read by. I have always stood  $\frac{20}{20}$ , but may have to go and see Dr. Hubbell yet. I thank you for the kindness of allowing us to attend this convention of this association. Engineers are in a little different class as to sight. They are men that would be called ordinary good in sight, but they can see more than good sight at times. That is, put them there in the cab and they can see more than all you people with your glasses. I am not going to talk here on eyesight. In regard to your seeing better at night: I have been constantly on an engine—if I live two months longer, 46 years in one company, [Applause]

and I might throw a little light for those people that want to know the reason. You say to see a semaphore one mile in day time is doing well, but at night there is no semaphore to see and you see the light. And where you can see a semaphore a mile in the day time, in the same place you can see the next one two miles. It is the absence of the light that gives you the benefit of the white or red light. We have our caution signal and the danger signal. Approaching these signals, if both are down we have a clear track for two miles, if the signals are working. If the yellow is up and the other down, we have a clear track for a mile. We must go prepared to stop before we pass the other block, but it is clear to that block.

Another thing is the breaking of glasses. I do not want to tell my own experience, but once going 50 miles an hour and passing another train I felt something hit me. I went over against the back board, and the fireman did not see it. I was blind. I reached the break-handle and I shouted to him, "Look out! she's stopped;" and he looked to see what it was, and it was a bunch of grapes some tramp had thrown at me. If a man is blinded for a moment there is always relief right there. It is always within reach, and he can do it with his eyes gone, and he has a fireman that is supposed to have good sight—he can call him. I am getting along in years and do not expect to last much longer, but I would like to finish up my 50 years.

Dr. Vail: I think we will all be willing to trust ourselves in your hands a while longer.

MR. A. HOFFMAN (by invitation): I am a Lake Shore passenger engineer. You see a light at night further than in the day time. The semaphores are three feet long. They always have a background, but at night you do not see the background, just the light, and that is the reason you can see it further than in the day time. We have 250 signals between Cleveland and Buffalo, and it keeps a man guessing on these fast runs. Dr. Black came up this morning with me. We have 3:55 to make the 153 miles. When I see a semaphore at a mile, there is lots of time to calculate whether I have to go slow. I have been 26 years running an engine and 33 years firing and engineering, and I may be turned down for

my sight pretty soon. I can see just as far as any one, and I guess could pick them out on the road, and know every inch of the way, and know where every siding and signal is located. But of course the sight question is bound to knock us out.

DR. J. E. COLBURN (Chicago): Some years ago I was on the plains hunting. I had  $\frac{20}{20}$  vision; I have trained myself for a number of years to observe things carefully, being something of an amateur artist. I was with a man who had lived in that country, and he pointed at considerable distance and said, "There is a wolf climbing along that bluff," and he located it by a shrub at one point and another patch below it. I looked at it carefully and could absolutely see nothing. He fired his gun and the wolf jumped, and I could see it. He came into my office during the following year and his vision was less than  $\frac{20}{40}$ , had a compound hypermetropic astigmatism. It was the training that he had that made his sight accurate and enabled him to estimate what he saw, and that is what makes the old engineer's sight valuable to the road.

DR. BLACK (closing discussion of his paper): With reference to Dr. Parker's suggestion that when men come up for examination with hypermetropia of 1 or 2 D. to turn them down, it would, I think, in the end tend to give us engineers who would not need glasses for distance in later life; but, as Dr. Snyder has pointed out and as Dr. Würdemann and Dr. Jackson have said, it is utterly impossible to get enough men to supply these positions on railroads without 1 or 2 degrees of latent hypermetropia. Regarding scotoma and the amber glasses, while there is a slight one from looking directly into the fire-box with amber glasses on, it is reduced so much that it does not interfere with the seeing of the signals at night. I gave the opinion that with  $\frac{20}{100}$  vision in one eye and even below that in the other, if vision of both could be brought to normal with glasses, the man could be considered safe for an engineman. It would probably be safer to say not less than  $\frac{20}{50}$  in one eye, because with this amount of vision in one eye he can finish out his run to the end if deprived of his glasses. Too much cannot be said in favor of the protecting glass. Ninety-five per cent. of the men carry these glasses for all



sorts of emergencies. The question of monocular diplopia was referred to by Dr. Duane. Regarding reflection of light by the lenses causing hyperopes not to see so well with their glasses at night, if you will take two lights of equal photometric value and place before one of them a white crystal lens you will find with a photometer a large reduction of the original source of illumination that goes through this white lens, that is, a considerable amount of light is reflected and absorbed in passing through this glass. At night the small amount of illumination objects have is very much effected by the reflection of the lenses and is so diminished; but the night signals are self luminant, and the diminished vision with glasses at night will make no difference in seeing them. As to enginemen wearing a glass surreptitiously, I have seen it time and time again, and they say they feel safer.

Mr. Tanke, who spoke to us a moment ago, was the engineman who really made the record run from Chicago to Buffalo for the World's Record. When he took the train at Erie they were behind the record, but he brought it in ahead of time with an inferior engine.

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## FIXATION OF THE EXTERNAL RECTUS MUSCLE IN NYSTAGMUS AND PARALYSIS.

BY J. ELLIOTT COLBURN, M.D.

CHICAGO, ILL.

A RECENT abstractor of my former article on fixation of the external rectus observed that I was going counter to the teaching of ophthalmology in employing fixation as a means of improving vision in nystagmus. The following note will explain my position:

Nystagmus of congenital origin, not due to atypic development of the brain, may be improved, in some cases, by the correction of an error of refraction and the addition of sufficient plus strength to allow of excessive convergence. When the error amounts to an exotropia, a strong plus glass before the fixing eye, and that eye strongly abducted, allows of clearer vision with a minimum amount of oscillation. Noyes has reported good results from complete tenotomy of internal recti. In most of the congenital or idiopathic cases which

have come under my observation, the position of greatest rest was that of marked abduction of the fixing eye, whether the refraction was plus or minus, and the effort to see most accurately was always made in that position. Whatever may have been the refraction, the object to be seen was held as closely to the eye as possible, apparently with the purpose of diminishing the excursion of the image upon the retinal field. Nystagmus has disappeared in patients suffering from a high degree of error of refraction after wearing a full correction, even though in some cases the visual acuity remained far below the normal. The above, together with observations made by Snell, Oglesby, Noyes, Stevens and others, would seem to contradict the theory of Van Arlt, that the object of the more or less rapid movement of the eyes, or eyes and head, was an effort to bring a greater number of perceptive elements into the field.

In the *Ophthalmic Record* of August, 1904, in a paper entitled "Partial Fixation of the Globe for the Improvement of Vision in Certain Cases of Nystagmus," I reported a procedure which seemed to promise some improvement in vision of patients suffering from nystagmus who are not relieved by other means. The operation consisted in fixing the external rectus muscle to the temporal wall of the orbit. The following is the method which was used: After complete cocaine anæsthesia the eye was placed in a central position by an assistant and a small wound made in the conjunctiva at the temporal cul-de-sac for the purpose of marking its position. The eye was then rotated inward, the conjunctival cut enlarged and the muscle exposed. The external orbital-muscular check are freely excised and the periosteum wounded. A doubly-armed suture was passed through the muscle, then deep into the periosteum and out into the conjunctival sac and tied. I have now modified the operation by carrying the suture out through the integument and tying over a plate tin button.

I have found the needle which I had made by F. A. Hardy & Co. of great service in placing the suture in the muscle. The suture can be then threaded into a strong curved needle and with a properly constructed needle holder passed out and through the integument.

The first case of the last series was one of lowered vision due to ophthalmia neonatorum. Miss M., aged 18 years, had ophthalmia soon after birth. Vision— $R=4/200$ . Not improved by glasses. L=light. Right eye—very slight oscillating nystagmus. Point of greatest rest—eye converging to 30 degrees. Left eye—turned 30 degrees outward and upward, exposing only a small portion of the cornea below a drooping lid. When the eye was brought as near to the median line as possible there was violent nystagmus. Relief was sought to correct the unpleasant effect of the outward and upward rotation of the left eye. The first step was the fixation of the left external rectus, and four weeks later an advancement of the internus was made. The result was almost perfect quiet in the median line. The right internus was tenotomized and held in position by the fixation suture, securing straight-a-head fixation. The cosmetic effect was all that could be desired, and the improvement of vision= $20/100$ .

Dr. Casey Wood suggested at the time that I made my first report that fixation of the recti muscles might be of use in selected cases of paralysis of the recti muscles. The following case—Mr. L., aged 24 years, complete paralysis of the right internus following an injury—seemed to offer a good opportunity to make the trial. Vision— $R=2/100$ . Not improved by glasses. L=normal. The right cornea was partially concealed in the drooping lid and held well in the external canthus. The right externus was fixed, and the internus, with the capsule, advanced about four weeks later. The position at this time—eight months after the operation—is, when at rest, 5 mm. to the nasal side of the normal, with 10 mm. rotation.

In the third case, Mrs. L., aged 42, paralysis of the third nerve, and lowered vision in the left eye following an injury to the head seven years prior to the first visit. The eyes were completely rotated into the external canthus with 2 or 3 mm. of converging motion, the head always tilted forward and turned away from the object viewed. Fixation and advancements were made, resulting in the slight convergence of both eyes and 5 mm. to 10 mm. lateral range of motion of the right eye.

My limited experience with the operation for the improv-

ment of vision in case of nystagmus leads me to consider it favorably. The cosmetic effect in suitable cases is all that can be desired. In paralysis of the ocular muscles or any set of them, it is certainly more desirable than the operation for exsection, and more satisfactory than the advancement of the paralyzed muscle without the fixation.

#### DISCUSSION.

Dr. L. A. W. Alleman (Brooklyn): I owe you an apology for opening this discussion. I was not informed that I was to open it until I was in the country, and away from my books. Personally, I have no experience with the operation. I have seen some cases corrected by lenses, but have never had an operative case, and I feel that I have learned much in listening to this excellent paper, but have nothing to contribute to its discussion.

Dr. Mark D. Stevenson (Akron, Ohio): I have found the results of capsular advancements very gratifying in most cases of paralysis of a rectus muscle. The eye is fixed in the middle line, and the limited rotative power is more or less compensated for by the movements of the head and neck. Such operations should not be performed until other measures have been tried and ample time—one year or more—has elapsed. If the compensatory head and neck movements are sufficient in such cases, they should also be so in cases of nystagmus where the vision of both eyes is nearly always very defective. It would seem very good practice to fix such eyes with strong capsular advancements.

Dr. Valk (New York): This method of Dr. Colburn seems very similar to the method employed some time ago by Agnew with the guy in an operation for strabismus; a suture was put into the conjunctiva and then passed through the skin at the external canthus, and the eye tied out in that way. It seems to me there should be a very good result in Dr. Colburn's method of operating. With reference to nystagmus, I hardly think the operation would be of service, if it is due to central causes, but if it is due to the want of motility or a refractive error, it might be very serviceable, as the only objectionable feature would be the decided reduction in the motility of the eye, and the diplopia in the outer parts of the field.

## THE SUBSTITUTION OF ADVANCEMENT FOR TENOTOMY IN THE SURGICAL TREATMENT OF DEVIATIONS OF THE RECTI.

BY EDWARD J. BERNSTEIN, M.D.

KALAMAZOO, MICH.

IN hardly any other field of ophthalmology have we so much to learn as in the treatment of deviations and abnormalities of the external eye muscles. It is not improbable that we are to-day approaching the solution of the problem with a more rational adjustment of remedy to cause.

It seems almost inconceivable that from the day of Diffenbach in 1839 till to-day the object of all or most all operators has been to make a pathological condition the standard; in other words, when it had been found necessary to bring about a degree of parallism, the course was to make an otherwise healthy muscle equal the faulty one, thus substituting two weak muscles (more or less equal in strength) for one weak and one relatively strong. It would seem that the more rational way would be to attempt to bring about such a condition that one would have two equally strong (healthy) muscles. To bring about the first mentioned effect tenotomies are done, for the latter, advancement.

In order to properly estimate this assertion, you will pardon my calling your attention for a moment to the anatomical and physiological factors in the motor apparatus of the eyes. The external eye muscles are so placed and enervated that they hold the globe in certain position and revolve it about a pretty constant point. Their functions must be carried out with mathematical exactitude, for it concerns not merely the motion of one eye, but rather the synchronus action of both upon the same point which the individual wishes to see clearly. Even in the position of rest, muscular activity is necessary; these actions work in various (antagonistic) directions. We see thus how the four recti, whose function it is in synchronus action to withdraw the globe into the orbit, are checked by the action of the oblique muscles, whose action is to pull it forward. In the same manner, rolling of the eye (turning about the sagittal axis) in one direction is controlled or held in check by opposing muscles.

If the globe change its direction by the action of one set of muscles, at once the antagonist or opposite set are called into play; not to hinder the first set, but to make their action more exact, to prevent them taking the eyes too far in a given direction and to keep the eyes steady in their new position. We must constantly bear in mind that while we are awake the eye muscles are in more or less tonic contraction. The correctness of this observation is seen when one muscle loses its activity, i. e., in paralysis, when at once its antagonist is brought into full play. Had binocular vision been present before, at once diplopia comes to light. The false image then takes the direction to which the paralyzed muscle would have taken the eye under normal conditions. The diplopia, as well as the false projection, increases in the sphere of the paralyzed muscle. The working of tenotomy—that is, loosening of a muscle from its insertion on the globe—is precisely the same in fact as paralysis. If the operation is done so gradually that the muscle takes up its new position not far from its normal insertion, there results a slight insufficiency, equal to a mild paretic condition. On the other hand, has a tenotomy in the ordinary acceptance of the term been done, then we have all the symptoms which characterize a paralysis.

When a tenotomy is performed upon a rectus, the eye is pushed forward out of the orbit, just as in paralysis of such a muscle; for then the muscles mainly concerned in pulling the eye forward are the gainers in equilibrium. The excursion in the direction of the retracted muscle is decreased; in the like direction false projection, and if binocular vision had existed diplopia ensues, depending in degree upon the weakening produced by the operation.

The retro-emplacement (by tenotomy) in a case of paralysis of one muscle—the rectus internus for example—when done upon its antagonist (the externus) differs in one respect in its effect from the enervation paralysis. If an eye is strongly everted, in a case of paralysis of the internus, and the externus is tenotomized, then the retro-emplacement of the externus is not very marked, just because the contractility of the internus is decreased. The decrease in excursion, the false projection, and the diplopia in its direction, remain.

We have added now the paralysis of the externus, to one of the internus. By the tenotomy of one of the horizontal acting muscles, the symmetrical action (convergence or divergence) is without question decreased.

When binocular vision is present, tenotomy of an internus produces an insufficiency of convergence, which by reason of the crossed diplopia renders near work impossible. It is true, one concerns one's self little about the amplitude of convergence in concomitant squint, because binocular vision does not usually exist, and we have made little attempt to awaken this function. But in a true conception of our ability to cure squint, we should attempt not only to bring about what Landolt calls a "photographic cure," but also binocular fixation and the fullest approach to normal amplitude of range. This range is 30 degrees of the arc for both the externus and the internus.

When tenotomy is done upon muscles whose action is not so simple as the internus or externus—on the superior or inferior recti, whose action is more or less aided by the oblique, the result is the same—a paretic motion. Its consequences are, however, less.

This view of the result of tenotomy—credit for which is mainly to be given to Landolt—is at variance with the commonly accepted one. As a matter of fact we have been accustomed to thinking that tenotomy decreases the excursion of the eye in the direction of the retro-emplaced muscle, and that only for the excess which the strabismus brought out. Beyond this we gain for the not operated (antagonist) muscle as much function as was lost upon the tenotomized muscle. Actual trial of the excursion, convergence, the projection, and binocular vision before and after operation, prove the contrary. The retraction of the tenotomized muscle, the contraction of its antagonist and pushing forward of the globe cause the tenotomized muscle to be attached very much farther back than just so far as the contraction of the antagonist would carry it. This is contrary to the theory of action held heretofore.

The influence of the tenotomy upon symmetrical movements of the eyes must not lead us astray. We all know cases in which the external rectus has been severed for insuf-

iciency of convergence, where a true convergent strabismus has resulted. And that the danger of converting a convergent strabismus into a divergent one with subsequent loss of vision, protrusion of the globe and loss of convergence, is an all too common experience to require further words.

The action of advancement is directly the opposite of paralysis and of tenotomy. Advancement consists in bringing the attachment of a muscle nearer the cornea. Thanks to this procedure, the power of the muscle upon motion of the eye is increased. There are two methods of producing this effect: either cutting the tendon free and re-attaching close to the cornea with the aid of sutures, or by some tucking operation. This latter seems to give a good deal of satisfaction at the hands of many. It may be characterized as the bloodless, while the former is the bloody operation. In case of advancement it has been maintained that the antagonist has lost considerably in mobility. It is believed that such observation is not the result of actual trial.

Why should the influence of the internus be decreased by the advancement of the externus? We do not interfere with the internus. The activity of the internus is not passive, but active, that is, when it is called into action as antagonist of the internus. If one wishes to turn one's eye to the right, the enervation impulse to make the left eye do this is sent, not to the externus (which turns the eye out), but to the internus.

These simple statements are fully sustained by actual trial. The excursion of the eye in the direction of the advanced muscle remains intact. If any change occur, it is rather an increase of action for both; and this is because the eye is pushed further back in the socket and the antagonist muscle has gained in tone and range of action.

Given a case of convergent squint, the amplitude of range of all the recti will usually be found short of the normal. Advancement of both externi will show not only an increase of power for externi, but the interni as well.

It is indeed strange that errors of the scope of advancement operations should become current, and it is usually explained upon the ground that unfounded theories rather than firm facts are most readily accepted, especially when it



is necessary to confirm the latter. It seems that many think of the muscles as firm bands between which the globe is fastened; while we know they are really contractile organs.

There are four methods of securing an advancement, viz: simple advancement to the cornea, tucking, advancement together with shortening and resection with re-attachment of the shortened muscle at its old site. The two latter are done when heightened effect is sought. The advantage of the last named (re-attachment at the old site) lies in the claim that we thus run no chance of altering the vertical position, that is to say, that we do not elevate or depress the horizontal meridian. The disadvantage lies in the fact that we get less effect thus than by simple advancement, and that it is better if shortening is needed to sacrifice the tendon rather than the contractile muscle. By careful operation, the danger of altering the horizontal meridia is practically nil. If shortening has not been too radical, the influence on this muscle is a gain as far as its excursion is concerned, and certainly no disadvantage to the antagonizing muscle.

Look at the eye muscles in the cadaver. Most of us are astonished when we see these long, relaxed, vermiform structures and recognize them as the eye muscles. Now how much may we shorten these before they, despite their tone, would influence the rotation of the globe in the opposite direction? Only when so large a piece has been sacrificed that the eye is held fast even in its relaxed state. This may only be permitted in an absolute paralysis of the muscle, and in this case the result is a decided improvement upon the pre-existing one. At least, the operation brings the binocular field of fixation directly before the patient and at the same time corrects the deformity perfectly.

Advancement (simple or in combination with resection) is indicated in all forms of paretic muscle disturbances. And of this there can be no doubt. It is also indicated in concomitant squint and in insufficiency. In paralytic conditions the greater the effect desired, naturally, the larger the portion of excised tissue will be. Should the result not be sufficient in a given case, we augment it, not by tenotomizing the antagonizing muscle, but by advancing the corresponding one on the other eye.

As a rule, convergent squint is due to spasm of convergence, brought about by excessive accommodation due to hypermetropia—lack of static refraction—or to weakness of accommodation in cases where binocular vision is poorly developed (lack of dynamic refraction). As a rule, divergent strabismus (concomitant) is due to a relaxation or weakness of convergence. Therefore, strabismus convergent is an active, while the divergent form is a passive squint. But this is common to both forms, viz., that unlike paralysis, they concern both eyes. Therefore, in its correction, when operation is indicated at all, advancement should be done on *both eyes*.

An insufficiency consists in either lengthening out of the punctum proximum, or of a drawing in of the punctum remotum of convergence. The main symptom of which is diplopia, which becomes apparent much earlier than normal when the object of fixation is withdrawn or brought near.

The amplitude of convergence normally means a range of 10 meter angles positive and 1 meter negative convergence. It is necessary for continued application that we should have at least twice as much convergence power in reserve as the working distance calls for. If we hold that the working distance should be at  $\frac{1}{3}$  m. (3 m. angles), then the reserve should be twice 3 m. angles, or 6, and the entire energy is represented by 3 plus 6, or 9 m. angles positive convergence. Not having this, one must either increase his working distance or use abducting prisms. These have distinct limits of practicability. It is found impracticable to use prism stronger than would increase that convergence beyond 1 m. angle; over this, surgery must be our sheet anchor.

In the very nature of things, tenotomy is contra-indicated as increasing the already pre-existing insufficiency. To cure an insufficiency of convergence by a sacrifice of a portion of one's divergence, seems very poor reasoning. As a matter of fact, the tenotomy of the externi in such cases lead to convergent strabismus with homonomous diplopia in the distance, without correcting the insufficiency of convergence, i. e., the crossed diplopia for near vision.

For a fuller study of this question I would refer you to Landolt's classic article in Graefe-Samich (March 14, '05).

Quite independently of this master, and indeed unaware that he was at work upon this subject, I have for some time been doing just what is here indicated and in such cases that were not readily corrected by prisms to do an advancement. It has, however, in the past nine or ten months been my practice to do an advancement for cases where formerly I should have tried to prop along with prisms. My results have more than justified my hopes.

Though I have long felt dissatisfied with prism treatment and tenotomy, graduated and att., it was not until I had gained the mastery of the advancement operation as practiced by Dr. Jno. E. Weeks that I felt I had the proper remedy at hand. In an article before the section of ophthalmology a year ago, describing this operation, I spoke of my intention to thus treat all strabismus cases *not amenable to non-surgical means*. I believe the reason above all that has kept most men from doing this, long ere this, has been the want of the proper technique and instrument to accomplish it. This want I feel has been filled by Weeks' instrument and operation.

From my present view-point, it seems to me that tenotomy of a rectus muscle should be reserved for those cases alone in which there is a low degree of insufficiency of convergence, in which at the same time there is a decided overplus of diverging power. I believe even here that we shall not do so for long. It seems also indicated in cases of vertical deviation not helped by 2 to 3 degrees of prismatic correction; when tenotomy should be done upon the higher standing eye. When 4 degrees of deviation occurs, certainly whenever more than that amount of vertical displacement is present, advancement of the inferior rectus of the higher standing eye, or possibly dividing the effect on both eyes. Unfortunately, there seems to be, as yet, no means at hand of regulating the amount of advancement to be done.

Each case must be thoroughly studied from every side of the question. There is no place here for snap opinions or snap operations. Before undertaking an operation on the eye muscles, taking for granted that the refraction of each eye has been accurately corrected, the activity of each muscle should be studied for several weeks, and only after a most

painstaking series of investigations can one offer a solution to the problem.

I do not believe over 6 degrees, or even that much, prismatic correction can be worn with comfort for a long time. It seems clear that lateral deviations under 4 or 5 degrees do not require operative interference, and yet there may be circumstances warranting it, even under such conditions. Just how much a muscle must be advanced can only be gauged by the effect desired to be produced. It is possibly better to over-correct than under-correct. Then if it be found necessary, one can lessen the effect, either by removing stitches early or loosening up the new adhesions till the desired result is obtained, as tested by the point of light and colored glass.

Landolt has lately devised a new operation—lengthening of the antagonizing muscle, the clue for which he has gotten from the orthopædic surgeons. The object is in given cases to assume that position of adhesion shall be exactly on the site of tendon's normal attachment.

Finally, I should like to reiterate the belief that in a very short time tenotomy of the rectus muscle will almost entirely give way to advancement operations.

#### DISCUSSION.

Dr. Weeks: I will speak very briefly of the method of advancement I employ, which is not original with me by any means. I have perhaps modified some of the steps of the procedure. A linear opening is made through the conjunctiva, over the insertion of the rectus tendon, extending beyond the margins of the tendon and the conjunctiva and the subconjunctiva tissues are dissected backward. The center of the tendon at its insertion is divided, leaving the lateral extremities attached. Then a pair of slotted fixation forceps, with opposing blades that are supplied with teeth, is inserted and the loosened end of the tendon, the conjunctiva and subconjunctival tissues are seized. The forceps are almost as wide as the tendon at its insertion, and thoroughly control the tissues. Then the sutures, each of which carries two needles, are passed through from beneath the muscle. The two needles of the middle stitch are passed through well back, as far as is necessary to produce the effect desired, and 1 mm. to either side of the middle of the tendon. One of the needles is then returned, so as to pierce

the whole of the tissues at the middle of the tendon, making a "quilting" stitch, and passing beneath ocular conjunctiva, it enters the scleral tissue about 2 mm. from the corneal margin, and emerges at the sclero-corneal junction in the horizontal meridian. Before beginning the operation the horizontal meridian is marked on the conjunctiva, near the corneal margin, so that in returning this needle we have a guide to follow. The lateral sutures are now inserted, the "quilting" or the "simple" stitch being employed, as the operator may elect. The scleral ends of the sutures are brought on a line tangential to the margin of the corneal meridian pierced by the middle suture. After the sutures are passed through the tendon, the tissue that is grasped in the forceps is cut away and the forceps are liberated. I neglected to say that the lateral attachments are divided after the tendon is grasped in the slotted forceps. The middle suture is tied first and then the lateral sutures. The attachment to the globe is a broad one. It is not my custom to confine myself to advancement, although I am doing it more of late than tenotomy. In many cases the tendon of the opposing muscle is divided wholly or in part. I do not agree with those who think that partial tenotomy cannot produce any permanent effect. In heterophoria it is my custom to measure the strength of the individual recti muscles, which can be done with sufficient accuracy with the tropometer designed by Stevens. A number of measurements are necessary to determine which are the stronger and which are the weaker muscles. In many cases one will find that one rectus muscle is actually stronger than the others, and if we are going to do a tenotomy the muscle is indicated positively. As a consequence the surgeon can operate with the assurance that he will benefit the patient.

Dr. Colburn: The question of advancement has been of great interest to me. I have used various forms of advancement. I am inclined at present to use one that I have once or twice described. My preference is for a combined operation of section and tucking, which is really shortening of the tendon, and not an advancement. The operation I prefer is described as follows (Fig. 9): Open the conjunctiva just anterior to the tendon attachment, dissect backward, making a tongue-shaped flap. Grasp the tendon and make a buttonhole extending across the attachment, with the exception of a narrow band of fibers on either side, as in graduated tenotomy, K. K. Split the tendon through its center as far back as is desired to secure sufficient shortening, H. H. You now have a T or Y

shaped incision in the tendon. Introduce a suture posterior to the opening in the distal end of the incision in the tendon; re-enter the sclera at the cut end of the tendon, and bring the needle out at I, introduce two sutures at M and L M'. L'. Tie first the central suture, then the lateral sutures. The operation is simple. No special instruments are required, and there is no danger of displacing the tendon. There is no deformity following the operation. The dosage is accurately determined. There is no permanent thickening and the results are certain.

Dr. Valk: I would ask Dr. Colburn why he does not use cat-gut instead of silk.

Dr. Colburn: Because the gut does not tie as readily, and does not stay put where I want it. I have tried the various preparations of gut, but cannot depend on my stitch.

Dr. Valk: How long do you keep them in?

Dr. Colburn: Five to seven days, if I see no sign of trouble.

Dr. Mark D. Stevenson (Akron, Ohio): An advancement, alone or combined with a tenotomy, is practically always to be preferred to a tenotomy. Weak and not too strong muscles are usually dealt with, and the operation should strengthen and not weaken a muscle. A careful study of the Y shape of the muscle, tendon and check ligament will make clear why an advancement will increase rotation, and not diminish it, as a tenotomy does; also why advancement of the capsule forward will not tend to limit the rotation of the eye to the opposite side, whereas tenotomy will limit rotation toward the side operated upon. Tenon's capsule pushed well back on the muscle or tendon can afford considerable support to the suture, and because of its great elasticity will not limit, ultimately, the rotation of the eye to the opposite side. Good anchorage in the sclera can nearly always be obtained, but unless the suture is looped on the muscle or tendon it is likely to cut its way through between the fibres. If the capsule is included in the suture, it prevents much bunching of the muscle, which can also be partly avoided in my operation by placing the two scleral anchorages a good distance apart. A strong, broad attachment results. My operation is a modification of Worth's and is fully described in the *Journal of the American Medical Association*, Sept. 9, 1905.

## DEXTROPHORIA.

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In my treatise on Strabismus, latent and fixed, issued last year, I made his remark, in regard to the classification of squint:

"To these conditions I would add certain tendencies of the eyes to turn to the right or left, in which, by the examination, we find a weakness of one internus and of one externus, giving a tendency to look to the right or left. I do not propose to suggest any special terms for this condition, but, as I have met some cases, prefer to note it in this classification and to explain it under the subject of heterophoria." Furthermore, on page 84, writing on Anaphoria, we find: "There are still other cases that may come under this classification, not infrequent, in which we have a tendency of both visual lines to turn the same way but laterally, in other words they tend to turn to the right or left. I have no terms to express this condition, nor do I think any have been suggested, but these cases are occasionally met with in an examination. Stevens has suggested that it is due to a condition of cyclophoria. I have not convinced myself that that suggestion is correct, but I am inclined to look upon all these cases as due to the same conditions as in all other cases of squint, that is to say, we have an essential weakness of one internus associated with a similar weakness of one externus, hence the tendency to look in one of the two lateral directions."

I do not know of any terms more suitable to express this condition of muscular imbalance than the one which I use as the title of this paper, while, in a case of a tendency of the visual lines to turn to the left, Lævophoria, suggests itself, at the same time it is a question in my mind as to the proper designation of this condition, hence the reason that this paper should be presented to this Society.

It is very true that if we study the imbalance presented by these cases and consider the results of our final examination, we will always find them complicated with—or, perhaps, they are a complication of—other conditions of heterophoria. The usual popular tests will show either Esophoria or Exophoria, and if so, then we may say that the lateral imbalance is complicated by this tendency to turn the eyes in a certain direction, as to the right or left. All this I think we can prove to be true, and, as I understand this condition, if we do have this complication its value is apparent, as it renders the mode of procedure much more simple in the treatment of all cases of lateral imbalance, either by exercise, by prisms or by an operation.

It is interesting, in connection with this subject, to note the position, in which objects are held when we look at them naturally. If we pick up an object and look at it, and we then notice the position of the object which comes most natural to us, it will be found directly in line with the mid-plane of the body. Furthermore, we find the base line of the eyes, that is, an imaginary line drawn from the center of rotation of one eye to the center of rotation of the other eye, at right angles to the mid-plane of the body. Then if we naturally hold an object in line with this mid-plane—a position analogous to that of the finger in pointing—it must be in a line with the middle of the base line between the eyes. Now, for the near point, the visual lines should be in the position of mutual balance between the eyes, and when the look is in infinity, the visual lines would be in the well-known position of rest. This position of holding an object in the midplane has been noticed and verified in the “one eye blind,” and seems to me to be a simple physiological act ordained by nature. To resume, then, if we accept this explanation of our natural position for the visual lines, and we have the condition of dextrophia present, it almost goes without saying, that we must have more or less strain on the weak internus of the right eye, and on the weak externus of the left eye, which must call for greater innervation of these individual muscles to hold the image of the object fixed upon the macula of each eye. Hence it seems justifiable to state that these persons must suffer, more or less, from certain symptoms caused by this imbalance of the ocular muscles, and it is also evident that at the natural position of the look the eyes cannot be at rest in dextrophia, except when they are slightly turned to the right or the head slightly turned to the left, both of which are unnatural positions. Moreover, if the eyes are under this condition of strain when the look is fixed upon an object, we can readily understand how much greater the strain must be on the innervation of the ocular muscles in the act of reading. It has been fully proved by the investigations of Dodge, and others, that the eyes must be perfectly stationary for an image to form on the macula—we are practically blind when the eyes are moving from point to point—and so in the act of reading the eyes are constantly moving and constantly stopping, as we read along the line of our book, and so constantly demanding an excessive nervous impulse upon these anatomically weak muscles.

As to the etiology of this condition, it seems to me very simple, as it must be due to the anatomical conditions only. If myopia and other conditions of the ocular apparatus may be inherited from



the parents, and I believe many cases are so inherited, then an imbalance of the muscular apparatus of the eye in a parent may be shown in a child, though not necessarily of the same character. I have noticed an exophoria well marked in a mother, whose child showed the condition of esophoria, and in other cases this tendency of the eyes to turn in a lateral direction. We may also note it in the history of some of our cases when the mother states that the child when young had "a cunning way" of turning the head to one side when speaking to others. These children, when examined later, will show this tendency to turn the eyes to the right or left, and their "position of rest" with the look in infinity becomes one with the finite point removed to the right or left from the extended midplane of the face. Hence, the visual line of the "cyclopean" eye, if such an eye could exist, would not be at right angles to the base line drawn from the centers of rotation of the two eyes, but would lie in a direction to the right or left. We may then conclude that this condition must be anatomical, and due to a weakness of certain muscles that are associated in the conjugate movements of the eyes—in other words, a weak internus associated with a weak externus of the fellow eye. As to what is the actual condition, anatomically, we must leave that to the operation to demonstrate, as we may have a faulty insertion of a tendon into the sclera, one of the opposing muscles may be too long, or too short, or one may be too largely developed, as compared with its antagonist. I cannot consider this condition in any other way, as I fail to appreciate what influence innervation of the muscular apparatus or the accommodation can have to do with this tendency of the visual lines in these directions. I have a letter from Dr. G. T. Stevens, stating that he has also noted those cases, and in which he suggests that it is probably due to cyclophoria, but I have not observed this condition in any of my cases.

Diagnosis: Ellett, in the *Journal of the Am. Med. Association*, Oct. 18, 1902, in his classification of the ocular movements of the eyes refers to the associated conjugate movements as versions, and suggests the names of dextroversions, levoversion, superversion and subversion. Accepting these associated movements of the two eyes conjointly, we find that Stevens had demonstrated that we may have an abnormal condition of the vertical movements of the eyes, as if, the superversion is too great, more or less, equally, we have Anaphoria, and conversely if the subversion is greater than normal, we have Cataphoria. Here we have two distinct terms that indicate an excess of rotation in the vertical meridians of the eyes, and if so, and from the same anatomical reasons,

may we not have the same excess of rotation in the lateral meridians or horizontal plane? I think that I may so state that these cases do exist, as I shall try to illustrate, and the names or terms I have suggested seem to me the most suitable for that purpose. A decided tendency of the associated visual lines to turn to the right would indicate Dextrophoria, and if to the left, Lævophoria.

Accepting the presence of this condition of an abnormal direction of the associated visual lines, the question of diagnosis becomes very important. I think that I may state that none of the usual tests for heterophoria will indicate this condition. It frequently exists more as a complication of Esophoria and Exophoria, in which a slight turning of the head to the right or left will at once render negative any evidence of this associated turning of the visual lines. Anaphoria and Cataphoria present the same conditions as regards the diagnosis, and these conditions are rendered negative by the subjects placing the head in an abnormal position, that is, either forward or backward, so as to correct the imbalance. Now this vertical tendency shows the same difficulty in a diagnosis as this lateral tendency, and it seems to me that we have only one method, and only one instrument of precision, by which this can be measured and the diagnosis made. This must be done then by careful measurements of the rotation of the eyes in the field of version. The perimeter will *not* give these measurements with sufficient accuracy, on account of the prominence of the nose, which interferes with the correct measurements of the full extent of the inward rotation. The tropometer of Stevens will give these measurements with almost perfect accuracy, and, in my judgment, is one of the most valuable instruments in the office of the oculist. In the measurements of the rotation of the eye, in all and every direction, this valuable instrument gives us an extremely useful objective examination, that can be quickly recorded and readily compared with the normal rotation of the eye. I cannot speak too favorably of the work I have done with the tropometer, as in many ways it has cleared up the diagnosis in some very obscure cases, and has clearly pointed out to myself the best method of procedure in the case then under consideration. The extent of the normal field of rotation or version seems to vary, according to the findings of other observers, but I think if accurately taken with this instrument, it will be found, in round numbers, about  $35^{\circ}$  upward;  $50^{\circ}$  downward;  $55^{\circ}$  inward; and  $50^{\circ}$  outward. A rotation of the eyeball about its center of rotation, such as this, is perfectly normal; it is sufficient for all the purposes of life, and is a

very clear indication of the absence of any heterophoria. I cannot conceive of any imbalance of the ocular muscles when the tropometer will show this normal rotation in the field of version. It becomes self-evident, then, that if this instrument may show a decided change in this normal field, that the measurements show a weakness of one internus and a corresponding weakness of an externus of the fellow eye, it must indicate a tendency of the eyes, in their associated movements, to turn to the right, Dextrophoria, or to the left, Lævophoria.

Now, in the examination of cases of fixed squint, either of the first or second class—that is, either with or without amblyopia—this condition of the rotation of the eyes is never found, as in my experience, the examination of the field of version, in all cases of convergent squint, will show a decided want of outward rotation of the eyes, with probably an increased inward rotation associated with it.

Symptoms and Their Diagnosis: Linnell writes of an ophthalmoplegia which affects the muscles of the eyes concerned in the conjugate movements, as that of the externus of the left eye and that of the internus of the right eye, and in which the patient would turn the eyes to the right, but in all these cases we must have a certain diplopia from the want of innervation to the muscles, while in the cases concerned in this paper we do not have diplopia, unless it should be due to traumatism, as from too frequent or too free operations on these muscles, nor do we have any fixed deviation of the visual lines to the right or left, but only a tendency for the eyes to turn in either of those directions, which can only be demonstrated by a careful examination in the field of version. A conjugate paralysis is not a dextro- or lævophoria; one is due to an intercerebral or cortical origin, and the other, in my opinion, to an anatomical fault. Savage writes of a conjugate center to turn the eyes to the right or left, but when the eyes are in the primary position the muscles are not innervated, they are simply in a state of tonic contraction, that is, a normal condition, and does not tend to cause any symptoms of eyestrain.

There are no special symptoms that would indicate this tendency for the eyes to turn to the right or left, but all these cases present the usual history of asthenopia associated with certain reflex conditions usually found in cases of esophoria and exophoria, particularly pain passing backward toward the occiput, nausea, car-sickness and dizzy sensations, with frequently a pulling sensation about the eyes, etc. In many cases they are much improved by the

use of glasses, by which we have a full correction of the refractive condition, under atropine, if necessary; but in some of our cases, in a short time, the glasses fail to give the desired relief, and the distress is still in evidence.

What are the indications that we may understand from this condition of the visual lines? That question will be fully decided by other tests, which may indicate what special condition of lateral imbalance may be present. Take as an illustration, a well-marked case of dextrophoria, as shown by the tropometer; here we have a weak internus of the right eye, and a weak externus of the left eye, giving a natural tendency of the eyes to turn to the right, but possibly held in the first, or natural position, of the visual lines by an excessive innervation directed to these weak muscles under the direction of the guiding sensation or fusion force. Then, if associated with this, we find by the application of the other tests, as Maddox rod, phorometer, or the prism test, a condition of esophoria or exophoria, the usefulness of the diagnosis and the indications for the management of these cases becomes apparent. To continue the argument, if we find a condition of esophoria associated with either dextrophoria or lævophoria, then the essential fault must reside in the weak externus of the right or left eye, respectively; on the other hand, if we find an exophoria associated with the same condition, then it becomes evident, from the same reasoning, that the essential fault must be in the weak internus, of the right or left eye, respectively. Savage writes of a center which controls the conjugate movements of the eye to the right or left. This has not been fully demonstrated yet by any investigator, but, even though these lateral movements of the eyes seem to be simultaneous, the tropometer proves that each visual line may move in an arc of different size in certain directions. In these cases we will find that the position of rest, when the muscles are not innervated, but the eyes held steady by their tonic contraction, is one in which the visual lines tend to deviate to the right or left, while that of the normally adjusted eyes is toward the midplane of the body, at a point situated in infinity.

Noyes and other writers speak of certain cases of muscular asthenopia in which we have a condition of esophoria at the distance, and exophoria at the near point of about twelve inches. That these cases do exist goes without saying, and when these cases have been noted the necessary procedure seems very uncertain, but if we accept the presence of dextro- or lævophoria, the indications become very much clearer. We have a weak externus,

causing the esophoria when the look is in infinity, and a weak internus when the vision is fixed on an object placed at the near point.

Now, I have always considered that in all cases of heterophoria our means of correction should be first directed toward the muscular balance when the eyes are in the first position. Hence, after the refraction has been fully corrected and the glasses have been worn for a reasonable time, then, if we fail to relieve the existing symptoms we must consider some operative measures for the correction of the muscular imbalance, if that is present. I here wish to state that I have very little confidence in the correction of any case of muscular imbalance by the means of prisms or the system of exercise of the ocular muscles by certain rhythmic movements. These procedures may seem to be of benefit for a time, but I believe the symptoms will soon return when the exercise is suspended and the former use of the eyes is resumed. There are certain conditions of low degrees of heterophoria, such as simple exophoria, that may be improved under the systematic use of muscle exercise combined with tonics, as strychnia, etc., but in the condition to which this paper refers they have completely failed in my own cases when faithfully tried. Having then decided that we can only improve this condition of imbalance by an operation, it becomes a question of much importance what operative procedure shall we institute? This is answered by the condition of heterophoria, shown by the tests with Maddox's rod, the prisms and the phorometer, and lastly by the location of the weakest muscle in the field of rotation. If we have esophoria, shown by the usual tests, then our attention must be directed to the weak externus. Conversely, if the same tests show exophoria, then the most essential fault must be in an excessively weak internus, and our procedure must be towards improving the power or tone of that muscle.

Treatment: The true value of the diagnosis of this condition of dextrophoria is shown when we come to the operative procedure that is necessary in certain cases of heterophoria, as we should now be able to note the indications for our operative interference. It goes without argument, that, if our cases of imbalance of the ocular muscles have been carefully examined, the refraction correctly adjusted with glasses and a reasonable time having elapsed, yet they have not been relieved of their symptoms of asthenopia or eyestrain, then the consideration of the muscular imbalance must engage our attention. As before stated, I do not

have much confidence in the exercise procedure or the use of prisms, as the results are only temporary, or, in many cases, they fail to give any relief and if they do have some beneficial effect, it means wearing glasses when they could do better without them, as some of my cases preferred to have a suitable operation. I would illustrate this by the two following cases from my books:

Mrs. J. B. Age 30. Has exophoria of  $5^{\circ}$  with dextrophoria.  $V.=^{20}/_{15}$ . Refraction emmetropic. Wearing prisms of  $2^{\circ}$  over each eye relieves the symptoms of eyestrain, but she does not wish to wear these glasses, and will not do so. Her adduction is about  $20^{\circ}$ , her abduction about  $10^{\circ}$ . The tropometer shows a tendency of the eyes to turn to the right, as R. E.  $45^{\circ}$  in;  $50^{\circ}$  out. L. E.  $50^{\circ}$  in;  $40^{\circ}$  out. Now, I do not think a tenotomy, either partial or complete, would be suitable in this case of exophoria, but considering the condition of dextrophoria, a shortening of the internus of the right eye would completely restore her muscular imbalance, correct the exophoria, and the tendency to a deviation of the visual lines to the right, so that the glasses might be dispensed with. Also Case 3823. Mr. H. H. R. Age 33. Has all the symptoms of asthenopia, both refractive and muscular. He has simple hyperopic astigmatism of 1 D. ax.  $90^{\circ}$ , each eye, with normal vision  $^{20}/_{15}$ . His refraction has been fully corrected with glasses, and these consistently worn for six months with some improvement in the symptoms. Two years before coming to my office he had been operated upon six times by repeated tenotomies without any improvement in his condition. Repeated examinations show esophoria with add.  $25^{\circ}$  and abd.  $1^{\circ}$ , with homonymous diplopia with a red glass placed before one eye. The tropometer shows R. E.  $40^{\circ}$  in;  $45^{\circ}$  out; L. E.  $55^{\circ}$  in;  $40^{\circ}$  out. Judging from this, a shortening was done on the left externus, and three months after we have complete cessation of the asthenopic symptoms. Add.  $15^{\circ}$ , abd.  $6^{\circ}$ , and tropometer shows R. E.  $48^{\circ}$  in;  $45^{\circ}$  out. L. E.  $50^{\circ}$  in;  $45^{\circ}$  out.

Taking these cases as fair examples of them all, our true value then is shown in the indications for our operative procedure. For, if we have an exophoria with dextrophoria, we must have one of the externi weaker than normal, and that would contra-indicate a tenotomy of an externus. Furthermore, in a case of esophoria with dextrophoria, we must have a weakness of one of the interni and again a tenotomy is contra-indicated. Following the same line of argument, we then have a clear understanding that, in case of lateral imbalance complicated with a tendency to turn to

the right or left, a strengthening of a muscle must be the first indication for any operative treatment. I have frequently written of my method of shortening the straight muscles of the eyes, which has been published in reprints and in book form, and having performed the operation for various conditions of ocular deviations, and tendencies to deviate, in over four hundred cases, I can speak with confidence of the final results in this procedure. The operation is not difficult, it is readily performed under the use of cocaine, its technique is simple, and its effects are lasting, as it improves the rotation of the eyes as cicatrization takes place. I have records and reports from cases operated upon some years ago, and in nearly all of them the improvement has been permanent with no return of the imbalance or complaint of the previous symptoms. In reference to the usefulness of this operation, I take the liberty of quoting from a private letter to myself from Dr. J. M. Banister, Major and Surgeon, U. S. A., whose name is well known in ophthalmic work in this country: "I use your method of advancement by tuck as a regular routine method, and have secured brilliant results with it. In cases of insufficiency of convergence, I take a 'tuck' in the internal rectus, without tenotomy of the externus, with results which was impossible under the previous ideas. Your operation is a great addition to my means of remedying muscular anomalies."

In conclusion, I give the histories of a few cases, in which the records will show the tendency of the visual lines to rotate to the right or left, as the case may be, and is well illustrated by the records taken from the examination with the tropometer. A careful study of the rotation of the eyes as shown in these cases will well repay the student of all muscular imbalance.

2157 Child, age 13. Periodic squint,  $V.=^{20}/_{20}$  with glasses, refraction Hy. with Ah. Add.  $30^{\circ}$ , abd.  $14^{\circ}$ . Tropometer, R. E.  $40^{\circ}$  in;  $50^{\circ}$  out. L. E.  $60^{\circ}$  in;  $30^{\circ}$  out. With glasses no squint. Lævophoria.

3117 Miss H. W., age 25. Squint when child, tendency to diplopia.  $V.=^{20}/_{15}$ . Hm. .75. Exophoria  $6^{\circ}$ . Add.  $12^{\circ}$ , abd.  $12^{\circ}$ . Trop. R. E.  $40^{\circ}$  in;  $50^{\circ}$  out. L. E.  $50^{\circ}$  in;  $40^{\circ}$  out. Better with prism over right internus. Dextrophoria.

3588 Miss A. R., age 20. Head-pain and blur.  $V.=^{20}/_{20}$ , Hy. 5 D. Esophoria,  $2^{\circ}$ . Add.  $10^{\circ}$ , abd.  $10^{\circ}$ . Trop. R. E.  $40^{\circ}$  in;  $45^{\circ}$  out. L. E.  $50^{\circ}$  in;  $40^{\circ}$  out.

3599 Miss M. H. G., age 28. Pain in the head constant and V. blurs.  $V.=^{20}/_{20}+$ . Ah. add.  $15^{\circ}$ , abd.  $15^{\circ}$ . Trop. R. E.

45° in; 50° out. L. E. 50° in; 40° out. Advised operation.

3628 Miss S., age 28. Constant head-pain and cannot use the eyes; no improvement with glasses.  $V.=^{20}/_{15}$ . Ah. 90°. Esophoria 12°. Add. 30°, abd. 5°. Trop. R. E. 50° in; 55° out. L. E. 62° in; 45° out. Operation, shortening left externus, relief. Trop. R. E. 50° in and out. L. E. 55° in; 48° out.

3636 Mr. D. M. L., age 35. Nervous, cannot read and V. blurs.  $V.=^{20}/_{20}$ . R. My. L. Am. Add. 8°, abd. 4°. Trop. 40° in; 50° out. L. E. 50° in; 38° out.

3724 Mrs. G. B., age 30. Pain back of head and neck; dizzy spells and nausea.  $V.=^{20}/_{15}$ . Hm. .75, exophoria 3°, add. 4°, abd. 10°. Trop. R. E. 45° in; 50° out. L. E. 48° in; 45° out.

3825 Mr. A. R., age 44. Pain over the eyes, shooting backward; cannot read.  $V.=^{20}/_{15}$ . Ah. 90°. Exophoria. Add. 10°, abd. 10°. Trop. R. E. 40° in; 50° out. L. E. 50° in; 45° out. Advised operation on right internus.

3862 Mr. T. F. W., age 25. Eyes red and painful vision blurs, and feels the strain on A.  $V.=^{20}/_{15}$ . Ah. ax. 180°. Esophoria. R. E. 50° in; 40° out. L. E. 45° in; 48° out. Lævophoria.

3886 Mrs. E. W., age 38. Nervous, nausea and cannot sleep, etc.  $V.=^{20}/_{15}$ . Hy. with Ah. ax. 90°. Orthophoria. Add. 10°, abd. 10°. Trop. R. E. 48° in; 50° out. L. E. 55° in; 48° out. Operation, shortening of right internus.

3892 Mrs. W. W. H., age 30. Pain goes backward from the eyes to the neck; pulling sensation.  $V.=^{20}/_{15}$ . Hy. exophoria 1°. Add. 15°, abd. 10°. Trop. R. E. 45° in; 48° out. L. E. 55° in; 40° out.

3905 Mrs. W. A. W., age 30. Head-pain, frontal, occiput, neck and back. Eye-strain.  $V.=^{20}/_{15}$ . Ah. ax. 90°. Exophoria 4°. Trop. R. E. 40° in; 50° out. L. E. 50° in; 40° out. Operation on R. Int.

The above cases are all that I found noted in my case books, as the records were taken from the last three hundred cases of refraction and motility. This is a small number noted that presented this anomaly, but as most of the cases were not examined in reference to this special condition, perhaps it might have been found much more frequently. Some of these cases might be considered as traumatic, as when examined they gave a history of having had more or less tenotomies performed without any relief. The majority of these cases seem to show dextrophoria, or a tendency of the eyes to turn to the right.



## DISCUSSION.

Dr. Geo. M. Gould (Philadelphia): May I ask Dr. Valk as to the relative frequency of dextrophoria and sinistrophoria, the relative number of cases of each?

Dr. Valk: I think the vast majority are dextrophoria.

Dr. Gould: This interesting condition, which I have never thought of before, until this minute, and did not even know what the term meant, has suggested to me a number of things. The doctor contends that we have here an anatomic condition. I think that heterophoria is not anatomic. I have not cut a muscle for heterophoria for a dozen years. None would cut the interni for 80 degrees of adduction power. But if a patient has 10 degrees of exophoria today, I can give him 80 degrees of adduction power in a week. Heterophoria, I think, is innervational in nature, and refractional in origin, and I therefore see no reason for tenotomy. During the reading of this paper a thought has struck me that may be somewhat illuminating. Throwing aside the idea that dextrophoria is anatomic in origin, how does a child learn to write? It is always by looking with the optical axes to the right. For twenty years this is kept up for several hours a day; will this not result in dextrophoria? We have also to deal with right-eyedness. We are right-eyed just as we are right-handed, 98 per cent of us, and if these children for twenty years learn to write with the optical axes tending to the right, will not that cause this dextrophoric condition? We should change the whole writing position, which is certainly morbid. This question is bound up with right-eyedness and the position in writing, which causes the larger proportion of our 27 per cent of lateral curvatures of the spine. Dextrophoria, I suggest, is caused by long-continued habit. Dextrophoria seems to be a modification of heterophoria, incurable by any operation. We must get back to the cause of it. So long as we write in the habitual position customary with children, so long is dextrophoria a helpful device of nature, and to change it would lead to worse mischiefs.

Dr. L. Howe (Buffalo): I must say that I think a large part of what we are talking about is simply misapprehension of terms. We speak of adduction and abduction, and what do we mean? That simply depends on the way we use the prisms. Ordinarily, we find the adduction to be 6 or 7 degrees, and the abduction 2 degrees less than that. But if you use the revolving prisms, you can bring adduction usually up to 20, if not 30, degrees. It is a ques-

tion of what we are talking about. As to the method of using the tropometer, I like it very much, and learned very recently it was an old instrument, the principle having been described by Nicati at a meeting of the Biological Society in 1876. We can get the field of fixation better if we put an electric light on one side of a perimeter, steady the head perfectly, and with a small telescope look at the eye and get the reflection from an electric light. But neither the reading of the tropometer nor of the perimeter is absolutely true. Eyes vary in different individuals in the amount of excursion and the measurements given show many variations. It is not surprising; think how often we have diphtheria and what its after-effects are. When Dr. Valk was asked if the tipping of the head was more on one side than on the other, he said it was much more frequently toward the right. But I am inclined to doubt that, as I have made a considerable number of such examinations, and have never been struck with the fact that this special tendency existed in such a very large percentage of cases. In this connection I think we should keep in mind that while the tipping of the head may be due to a malposition of the spine, this should not be confused with the difficulty of the ocular muscles.

Dr. Colburn: Some two years ago I made a study of the relations of the orbital cavities to the plane of the face, and my impression is that at that time I found that the planes or axes of the cavities were more frequently turned to the right of the median line than to the left. In a series of cases examined it was evident that the patients, from childhood, habitually carried the head to the left, often before beginning to write, frequently tipping down, but very frequently the position of the head would show that the inclination of the orbital lines were to the right, while the habitual pose was in the opposite direction. I have frequently seen an insufficiency of one muscle, in which the pose of the head was toward the weaker muscle, or the whole position and carriage of the body showed the patient was favoring that weak muscle, and not one of the cases I refer to had an inclination of the head toward the right or the direction of the visual lines toward the left, and both eyes were turned in the left direction.

Dr. Knapp: Habit has something to do with shaping our frame, by strengthening the development of our organs, but more important than habit is our birthday-trousseau—I mean our congenital properties—and yet these also may be considered as the consequence of habit. When I made more squint operations

(tenotomies) than now, I found that at least in two-thirds of the cases the left eye was more prominent than the right, under the same conditions of operation. In pondering on the cause of this prominent asymmetry, I put my index fingers at symmetrical points of the lower orbital edges, and found that the left orbital margin was more prominent than the right in the majority of cases. Now, what is the cause of this phenomenon, if it is a fact? I have not counted the cases which I noticed. It is a fact that the children, in more than two cases out of three, have the habit of introducing themselves to their predecessors in the first presentation, *i. e.*, the left part of the head forward.

Dr. Valk (closing the discussion of his paper): I have but few words to say. At our smoker last night one of the speakers said this was the Academy of Ophthalmology; that was the reason I introduced the subject before the members of this society, because I knew they were the best men in the country to consider it, and if it does not meet with your approval, we will understand so much the better. I have my convictions and Dr. Gould has his. I think he will find that the child turns the head to the right. There is the question of whether the cause is anatomical, or rests on the innervation theory, in divergent squint or in convergent squint, but when you come to these well-marked cases of anaphoria, is the innervation theory going to do anything for its correction? If the anatomical theory is true of cataphoria and anaphoria, we might say the same of dextrophoria. If you take a child and put it in a gymnasium and put it to work, and in six months it will have a certain amount of muscular power, but if you stop that exercise the muscles will go back. Winters, of New York, has demonstrated that if you take a child and build up these muscles in the proper way, they will remain as they are. You can get a certain amount of adduction by prism exercise up to 80 degrees, with some individuals. It does not stay there. Why not? In the course of six months you will have it down to the original point, so I cannot see what use we can have for the prism exercise. It will be better for a while, but will go back to the same condition again. Again it comes back to the question of muscle cutting. I do not believe in it, and would seldom do it. In some slight cases a partial tenotomy is indicated, but very few. These muscles are anatomically too weak. Simply increase the power of the muscle anatomically by an operation and it will be permanent. With reference to what Dr. Gould has said, in regard to the one-eyed blind. If he has lost one eye, and you give him anything to look

at he will not hold it in front of the perfect eye, but in the median plane. He will hold it right in front of him. Is the remaining eye, then, the dominant one?

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## FIXED FALLACIES IN OPHTHALMOLOGY.

By JOSEPH E. WILLETTS, M.D.

PITTSBURG, PA.

If evolution is not applicable to the human race, it is applicable to the profession of medicine, for truly no other profession has so surely evolved itself from nothing. Three hundred years ago, the blood drawn from under the wing of a white pigeon, the left foot of a turtle severed at full moon, and other like, was considered a panacea in certain ills. Rogues, attributing to themselves some supernatural power, and who cared not what mischief they did, so long as it turned to their own profit, practiced their fantastic and supernatural arts upon the credulous. In this dark chaos of sorcery, witchcraft and quackery, medicine was an art alone, not having reached the dignity of a theory, much less that of a science.

If we allow our minds to revert and reflect upon the horrors of an amputation, before the advent of anæsthesia, or the ligature, and compare it with today's painless operation, when we may at will have a localized or complete anæsthesia of the whole body, we are able to appreciate what anæsthesia has done for medicine. Imagine doing an operation for cataract without an anæsthetic!

What inkling did the world have that it would be enabled to view the skeleton through the flesh until, like a flash from Heaven, came the Röntgen rays. What one of us present dreads diphtheria in these days of antitoxines, and who guesses at the diagnosis of malaria, typhoid fever or leucocytosis, with our present knowledge of blood counts and analyses? It was by strides such as no other profession can boast of that medicine leaped from darkness to dawn.

It is not my intention to dwell upon the origin of benefits of new discoveries, except to say that the advance of medicine has been so rapid that the profession, in keeping pace, has had no time to dispense with the obsolete theories and debris that silently swirl in the eddies of the stream of progressive medicine. It was the dreamers' superstition and the theorists, that entrenched medicine in the land of nowhere for more than two hundred years. It remained for practical hands to revolutionize and to restore it from

the theoretical to a scientific basis, and its future progress is not so much dependent upon new discoveries as it is upon the careful sifting of the evidence at hand and the elimination of its errors. Errors are more detrimental to progress than ignorance. For that which we do not know, we have a blank page to write upon, but a page scribbled with errors must first be erased. Medicine now deals with facts, not fancies.

This change from the theoretical to the scientific must be accredited to specialized medicine. The specialists' opinion cannot be evasive, it must be decisive, authoritative. One cannot become expert in any specialty, with fallacy and error for teachers. Fallacy and error, when found, must consequently be eliminated. It is this elimination by the specialists that makes them experts. It is this elimination of theory by the specialist, that has made the "New Medicine." Error committed in one's private practice may be corrected and no one the wiser, but error in a text book is capable of doing incalculable damage.

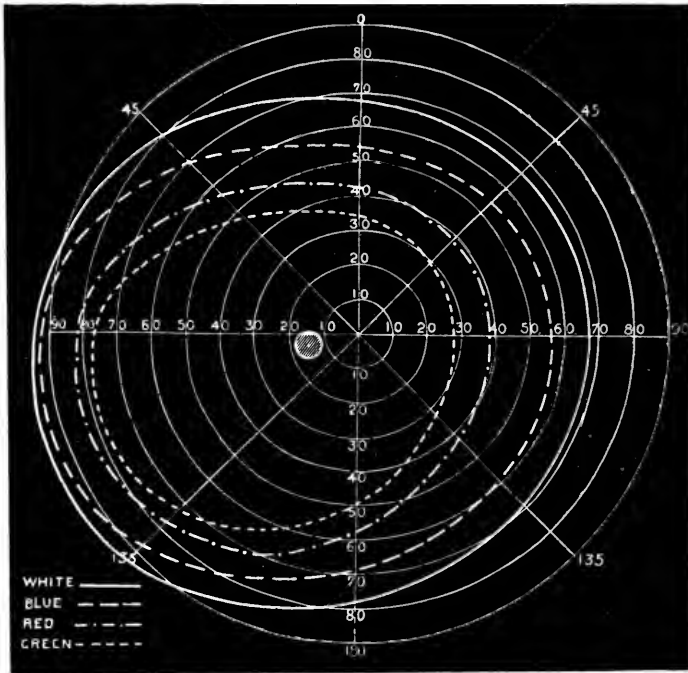
From time to time, various theories have been advanced to account for the phenomena of color perception. The original theory of Thomas Young (1807) supposes the retina to contain three (3) sets of color-perceiving elements: one for red, one for blue and one for green, and further says that the blindness for any one of said colors indicates an absence or paralysis of said element for said color. According to the teachings of the text books, the perimeter shows that the greatest contraction of the field of vision for color, is that of green. This zone extends upward 27 degrees, inward 25 degrees, downward 30 degrees, outward 50 degrees, and includes central vision. As we recognize all color with our central vision, why teach that this area of the retina is composed of percipient elements specially adapted for green? Why block out an area for blue and red, when said colors are perceived in the green zone and *vice versa*. Why teach that there is a contraction of the field of vision of the normal eye for various colors?

On page 32, Fuchs' second edition, is the following:

"If the examination of the field of vision for color be made with the ordinary test objects used with the perimeter (color squares of paper, one to two centimetres in diameter) the most peripheral portions of the retina are found to be color blind."

The peripheral portion of the retina is intended for orientation alone. Its percipient elements are the same, histologically, as those at the fovea centralis, but more widely separated. We see a moving horse from the corner of our eye, but we do not see its

color, true, nor do we see its harness, (which belongs to the form field) until we fix our central vision upon it. The condition for physical sight is light, all objects are seen by reflection. If we choose to diminish the light and reduce the object, to suit man's invention, we may do so, but no writer of a text book should take the liberty of altering the function of the retina to suit the instrument, which in this instance is the perimeter. The perimeter demands that we employ colored squares not exceeding two centimetres in size, so that the field may conform with its own powers.



It also demands that we ignore an error of 6 degrees and 97', due to the compulsory convergence for so near a point of fixation. This known error may be added to the net result, but the error caused by the physiognomy (which varies in each individual) and the personal equation, (which varies with the intelligence of the patient) are unknown quantities.

In 1896, I constructed a cone-shaped, hexagon prism, with its sides cut at an angle of 73 degrees, 40', made of flint glass, with an index refraction of 1.584, which deflected six lights upon the retina at an angle corresponding to the degree of 70 degrees, as taken by the perimeter.

With this instrument, the error of 6 degrees, 97' made by the perimeter, and also that caused by the physiognomy, was avoided.

Formula for a prism in the position of minimum deviation.

Let  $n$  = index of refraction }  
 $A$  = angle of prism }  
 $d$  = min. deviation }

$$\text{To find } d, -\sin \frac{1}{2} (A+d) = \frac{n \sin \frac{1}{2} A}{n - \cos \frac{1}{2} d}$$

$$\text{To find } A, -\cot \frac{1}{2} A = \frac{\sin \frac{1}{2} d}{\sin \frac{1}{2} d}$$

Formulae for a prism when the incident ray is perpendicular to the second face of the prism.

Let  $n$  = index of refraction }  
 $A$  = angle of prism }  
 $d$  = deviation }

Given  $A$  to find  $d$ .

$$\left\{ \begin{array}{l} \sin r = \frac{\sin A}{n} \\ r' = A - r \\ \sin d = n \sin r' \end{array} \right.$$

Given  $d$  to find  $A$ .

$$\left\{ \begin{array}{l} \sin r' = \frac{\sin d}{n} \\ \cot r = \frac{n - \cos r'}{\sin r'} \\ A = r' + r' \end{array} \right.$$

Example:— $n = 1.584$ ,  $A = 75^\circ$ , to find  $d$

$$\begin{array}{rcl} \log \sin A & - & 9.9849 \\ \log n & - & 0.1998 \end{array}$$

$$\log \sin r \quad - \quad - \quad - \quad 9.7851, r = 37^\circ 34'$$

$$r' = 75^\circ - 37^\circ 34' = 37^\circ 26'$$

$$\begin{array}{rcl} \log \sin r' & - & 9.7883 \\ \log n & - & 0.1998 \end{array}$$

$$\log \sin d \quad - \quad - \quad - \quad 9.9836, d = 74^\circ 21'$$

Example:— $n = 1.584$ ,  $d = 75^\circ$ , to find  $A$

$$\begin{array}{rcl} \log \sin d & - & 9.9849 \\ \log n & - & 0.1998 \end{array}$$

$$\sin r' \quad - \quad - \quad - \quad 9.7851, r' = 37^\circ 34'$$

$$n = 1.5840$$

$$\text{Nat } \cos r' \quad - \quad - \quad - \quad = 0.7926$$

$$n - \cos r' \quad - \quad - \quad = 0.7914, -\log 0.7914 = 0.8984$$

$$\log \sin r' = 9.7851$$

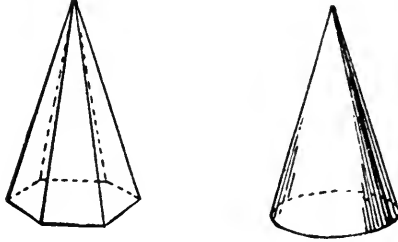
$$r = 37^\circ 37' \quad \log \cot r = 0.1133$$

$$A = 37^\circ 34' + 37^\circ 37' = 75^\circ 11'$$

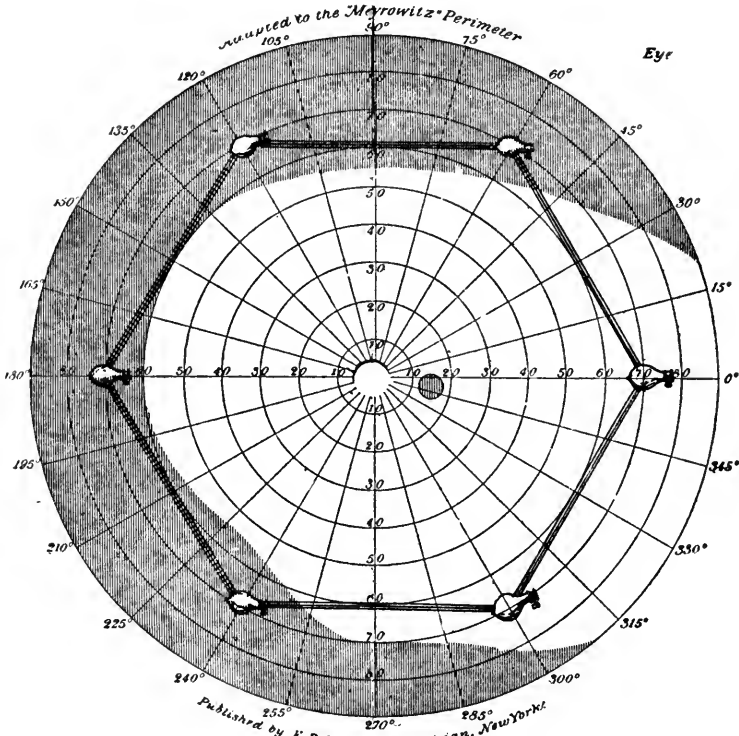
Noyes says, page 29, edition 1890:

"Outside of the field for yellow, only blue can be seen; and outside of the field for blue, no color is recognized."

Fuchs, on page 23 (Figure 13), says that the anterior border of the sensitive portion of the retina extends farther forward in the nasal side than on the temporal, in comparison as 65 degrees is to 90 degrees.



Author's cone and hexagon-prism, consisting of six prisms, cut at an angle of 69 per cent. combined as a whole.

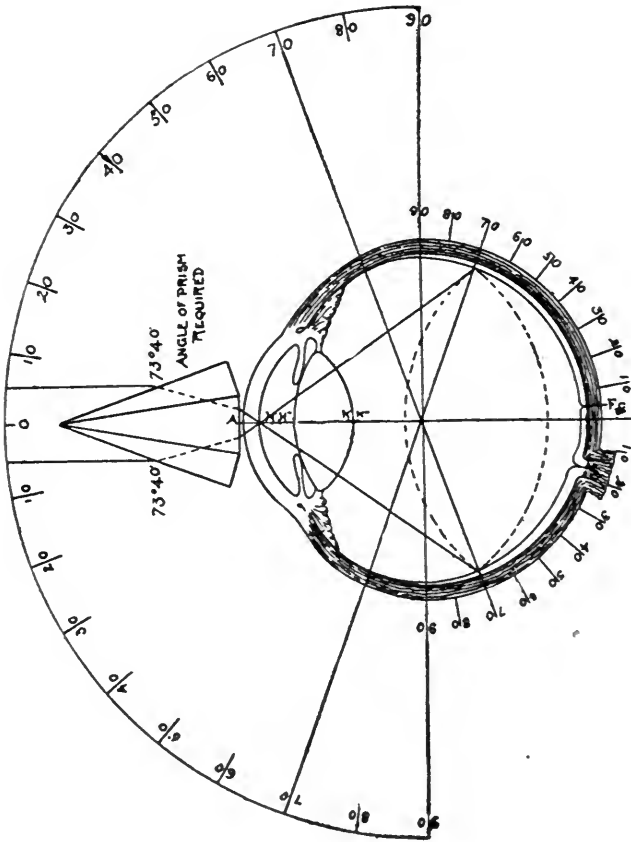


A rough drawing of the retinal images, as seen with the higher degree hexagon-prisms.

The prismatic perimeter has proved both of these statements to be incorrect. Outside of the field for blue, (which does not



exist) all the colors of the spectrum are discernable and recognizable, and the sensitive portions of the retina, are equi-distant in all of its meridians. The temporal portion of the retina perceives form and all colors at 90 degrees (the same as the nasal portion), if it be permitted to do so. The perimeter does not give this portion of the retina the opportunity, consequently, its function has been assumed negative, to conform to an incapable instrument.



Author's descriptive PLATE I. Illustrating the *modus operandi* of the prismatic perimeter.

One must take into consideration the varying degrees of light stimuli, in making an examination of the field of vision, but why make it the minimum, as we must do with the perimeter.

The diseases of the eye, which produce a contraction of the field of vision for form and color, are retinitis pigmentosa, glaucoma, optic atrophy and hysterical amblyopia, but by the time that this

contraction of the field is narrowed down to the requirements of the perimeter, the diagnosis, with the exception of hysterical amblyopia, is so apparent with the ophthalmoscope, that the one that takes the field to verify it, must indeed be sceptical.

If there is any one thing that the student of ophthalmology ought to be able to tie to, it is his text book. It should be stripped bare of theoretical deductions. It should be an absolute authority and contain nothing but demonstrated and absolutely incontrovertable fact. Bald fact, not theory. Surely not error.

The object of this paper, Mr. President, is to present a plea to a representative body for the careful revision of the color scheme by writers and the elimination of that inaccurate and misleading chart, which teaches a contraction of the normal field of vision for color.

#### DISCUSSION.

Dr. Spalding (Portland, Me.): I have been much interested in the paper, and if Dr. Willett's conclusions are true, and I have no reason to doubt them, it shows what errors will creep into the text books and remain, in spite of anything we can do. I think there are many others in the text books and that they might be studied with benefit. One is that atropine conjunctivitis is common. I have never seen a case in thirty years. Another is that eserine will contract any pupil; sometimes the pupil is so rigid it will not contract. It seems to me we do not study colors sufficiently, considering the importance attached to that portion of the sight. I had a patient in whom the sight for green and red, when contrasted together, was lost; for instance, in the autumn, when the leaves of the trees are so magnificently colored and the red leaves are sometimes mingled with the green. This gentleman has told me that looking at a lady's dress, green, printed with red flowers, that the moment he looks with his astigmatic eyes the red fades away and there is nothing but the green. It shows that astigmatism may be produced by changes in the choroid, which pressing on the color-perceiving rods and cones in the retina destroy color perception. A lady patient had an astigmatism at 90 degrees. The perception of the left eye for red was good. She had for this eye a plain cylinder, axis 90. She returned to me in great distress with an effusion at the yellow spot and great confusion in distinguishing colors. That patient's astigmatism had changed from 90° to 165°. In the course of three or four weeks it gradually swept back and today is 90°. This patient had the same trouble in

her left eye, confusion of red and green, as mentioned in the case of the gentleman, though not so marked. I think that all of us ought to make the time to study more about colors, color contrasts and examination for colors. This paper that has been read to us ought to be an incentive to us to discover further uses for color tests, and further truths as to the perception of color. Finally, the text books should be investigated for other fixed fallacies in ophthalmology.

Dr. Heckel (Pittsburg): I do not think there is any doubt about the fact that the field for colors is restricted anatomically, and that many an error has crept into our text books. I do not think there is any doubt but that color perception depends upon intensity. An English writer (Abney) has written a book with a number of experiments which brings this out clearly. In tobacco amblyopia, for example, it is well known that if we reduce the illumination we markedly reduce the visual acuity, and *vice versa*. The perimeters which have been invented with electric lamps completely defeat the purpose for which they were intended. The intensity of the color is so great that it utterly fails to reveal pathological constrictions of the field of vision. Recently, while looking over the literature to find something on electric ophthalmia, I ran across a statement in one of the books, about snow blindness, which stated that it "is in reality a disease of the conjunctiva," and is produced by the heat reflected from the snow. We know that we can have no light without heat, but the amount of heat reflected under these circumstances must be infinitely small. We also know that the blindness is not due to the conjunctival condition, but is the result of retinal exhaustion.

Dr. Willetts (closing discussion): The hexagon prism has proven conclusively that there is no such a thing as a contraction of the field of vision for red, green, or blue, as at present taught by all text books. It has proven it mathematically, and has given a method by which we may express its findings in a scientific way, instead of the present indefinite manner. Any member present may prove to himself, in a few minutes, that all colors are recognizable at the periphery at 80, and even 90 degrees, by turning on various colored electric lights and standing in line with the same with the face and eyes fixed at right angles with the light. The hexagon prism deflects to 70 degrees only sufficiently far to prove the fallacy of the Young-Helmholtz theory, which is inconsistent, unscientific and without a single iota of evidence to sustain it.

## UNDERGRADUATE INSTRUCTIONS IN DISEASES OF THE EYE.

By L. A. W. ALLEMAN, A.M., M.D.

BROOKLYN, NEW YORK CITY.

Specialization of knowledge and centralization of control are the signboards directing the man of today on the road of maximum efficiency to the goal, Success.

No individual, no class, escapes the influence of the spirit dominating the age.

The knight no longer rides forth to battle cased in armor, at the head of his retainers, trusting to brute force and courage to gain the victory.

Today victory comes to the man who thinks. As an illustration, take the story that comes to us of the recent campaign in Manchuria.

Contrast the two commanders, Kuropatkin striving bravely but blindly, in the thick of the fight, ignorant of the disposition of his own and the opposing forces, and fearing as much the insubordination of his own officers as the bullets of the enemy.

Opposed to him we have a cool intelligence. Far from the turmoil of the engagement Oyama sits in his tent, utilizing all the aid offered by modern science to keep in touch with every part of his command; confident of the ability and obedience of every man under him, he is free to concentrate his powers upon the problem before him and to coordinate and direct the ability and courage of every man in his command to carry out the plan which his genius has conceived.

In the no less serious battle we, as physicians, are called upon to fight, in our efforts to save life and alleviate life's miseries, we may well learn a lesson from the profession which aims at life's destruction.

The physician of today who fails to avail himself of the assistance offered by the skill and knowledge of those of his confrères who have devoted their lives to the study and practice of the special branches of our profession, is as much an anachronism as a Don Quixote tilting at shrapnel; and, on the other hand, a so-called "specialist," who forgets that he is a "Physician who confines his practice to a special branch," and that no part of the body can be successfully treated without reference to the rest of the economy, is as dangerous as the officer who attempts to fight his command without regard to the plans of his superiors. These

are all simple and self-evident propositions, and it may seem to you absurd to consume your valuable time with a reiteration of facts which no one will dispute, but my excuse is, that as a matter of cold fact, the most serious danger confronting our profession today, the one thing which does most to discredit the profession with the laity, is narrow specialism; a failure to grasp the proper coördination of a general and special medicine, and the text that I preach to myself and to my students, in season and out of season, is "Don't be a *Specialist*." This text I should like to see inscribed on the door post of every medical school, just below the other, "*Be Honest*." These two are fundamental, and are essential to an honorable success in our profession, be we surgeons, practitioners of general medicine, or so-called specialists.

It is a most difficult task, to discuss the subject which I present apart from that of medical education in general.

The utter and absurd lack of agreement, both as to the time required for a proper preparation for professional work, as well as to the proportion of this time which should be devoted to each branch,\* renders some formulation of a standard of requirement

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\*From Webster: *Curricula of American Medical Colleges* (New York and Philadelphia Medical Journal, July 23, 1904):

Some of the specialties are given an undue prominence, and an unmerited allowance of time in some of the schools; for example, 780 hours to orthopaedic surgery by the University of Nebraska; 570 hours to gynaecology by the Medical College of Ohio; 330 hours to aetiology and hygiene by the College of Physicians and Surgeons, Chicago; and 448 hours to dermatology and syphilis by Barnes Medical College, in St. Louis.

Further study of the statistics collected, but not included in this report for want of space and time, would readily disclose much useful information in regard to the relative time devoted to clinical teaching. This varies almost as widely as does the relative time devoted to each subject.

**GENERAL MEDICINE:**—Highest, Atlanta College of Physicians and Surgeons, 1,900 hours; lowest, Physio-Medical College of Texas, 78 hours. Average, 490 hours.

**GENERAL SURGERY:**—Highest, Atlanta College of Physicians and Surgeons, 2,221 hours; lowest, Physio-Medical College of Texas, 78 hours. Average, 536 hours.

**ORTHOPAEDIC SURGERY:**—Highest, University of Nebraska, 780 hours; lowest, Long Island College Hospital, 13 hours. Average, 61 hours.

**OBSTETRICS:**—Highest, University of West Tennessee, 460 hours; lowest, Physio-Medical College of Texas, 52 hours. Average, 169 hours.

**PATHOLOGY:**—Highest, Chattanooga Medical College, 646 hours; lowest, Willamette University Medical Department, 48 hours. Average, 251 hours.

almost a prerequisite to a consideration of the proper course in any specialty. I quite agree with the position taken by Dr. Jackson, in his able address, before this Association at the last annual meeting. The time devoted to preparation for professional work already seriously encroaches on the best years of a man's life, and I also agree with him in deploring the lack of opportunity for proper preparation for work in our special branch, afforded by medical institutions. Possibly there are opportunities for a man to become skilled in our special work, of which I am ignorant, but personally, I know of no other means of obtaining this training, save by work as an assistant in the office of some competent practitioner. What the remedy is, and what we should do about it, are problems which are respectfully turned over to the man who has solved them; I am satisfied, however, that they will not be solved by an increase in the time devoted to technical and purely special instruction in a course, the object of which is to prepare a man to become an all-around practitioner of medicine. I must confess that my own views on medical education have radically changed. At one time I regretted that I had not taken the college course preparatory to medicine, rather than the course in arts, but, should my son choose to follow me in our profession, I should

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**ANATOMY:**—Highest, University and Bellevue Hospital Medical College, 1,248 hours; lowest, Physio-Medical College of Texas, 126 hours. Average, 480 hours.

**HISTOLOGY & EMBRYOLOGY:**—Highest, Ensworth Medical College, 540 hours; lowest, Physio-Medical College of Texas, 26 hours. Average, 211 hours.

**PHYSIOLOGY:**—Highest, Atlanta College of Physicians and Surgeons, 750 hours; lowest, University of Virginia, 56 hours. Average, 341 hours.

**CHEMISTRY:**—Highest, University of Nebraska, 756 hours; lowest, Physio-Medical College of Texas, 78 hours. Average, 345 hours.

**BACTERIOLOGY:**—Highest, Chattanooga Medical College, 606 hours; lowest, Eclectic Medical College, New York, 20 hours. Average, 138 hours.

**PAEDIATRICS:**—Highest, Illinois Medical College, 392 hours; lowest, University of Virginia, 18 hours. Average, 98 hours.

**PHYSICAL DIAGNOSIS:** Highest, Atlanta College of Physicians and Surgeons, 475 hours; lowest, Melharrey Medical College, 20 hours; and Oakland College of Medicine and Surgery, 20 hours. Average, 97 hours.

**GYNAECOLOGY:**—Highest, Medical College of Ohio, 570 hours; lowest, University of Nebraska, 32 hours. Average, 181 hours.

**AETIOLOGY & HYGIENE:**—Highest, College of Physicians and Surgeons, Chicago, 330 hours; lowest, Columbian University, 8 hours. Average, 46 hours.

**NEUROLOGY:**—Highest, University of Michigan, 327 hours; lowest, University of Tennessee, 10 hours. Average, 83 hours.

strongly urge him to shape his preliminary education, to broaden, rather than to narrow his field of knowledge. If a student can bring to the study of his profession, a mind trained to depend upon itself, to run on a broad gauge, and if he has cultivated his powers of observation and concentration, he has, in my judgment, an ideal equipment.

Our aim is not to teach our students mere facts—we all know men of great knowledge who are failures; we should teach applied science; we should prepare the men, as best we can, for the unforeseen emergencies; in a word, we should teach them to think and act for themselves. How, then, can we best shape the course of instruction in diseases of the eye to equip a man to meet those cases which will of necessity come under his observation in general practice?

The increase in the number of hours devoted to a preparatory course has not been ideally divided. Surgery, for example, is, in many institutions, taught as a specialty. It seems to me as absurd to endeavor to equip a man, at graduation, with the ability to do abdominal surgery, as to make him a competent operator for cataract.

As it is impossible for us to reconstruct the college course to suit our own ideas, the problem is to make the best use of the time

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**MENTAL DISEASES:**—Highest, Western Reserve University, 268 hours; lowest, Bowdoin College, 6 hours. Average, 46 hours.

**MATERIA MEDICA & THERAPEUTICS:**—Highest, Hering Medical College, Chicago, 832 hours; lowest, Physio-Medical College of Texas, 52 hours. Average, 216 hours.

**PHARMACOLOGY:**—Highest, American Medical Missionary College, 330 hours; lowest, University College of Medicine, Virginia, 12 hours. Average, 60 hours.

**DERMATOLOGY & SYPHILIS:**—Highest, Barnes Medical College of St. Louis, 448 hours; lowest, University of Missouri, 10 hours. Average, 80 hours.

**LARYNGOLOGY & RHINOLOGY:**—Highest, Atlanta College of Physicians and Surgeons, 450 hours; lowest, Long Island College Hospital, 15 hours. Average, 85 hours.

**OPHTHALMOLOGY & OTOLOGY:**—Highest, College of Homoeopathic Medicine, University of Iowa, 432 hours; lowest, Melharry Medical College, 16 hours. Average, 124 hours.

**MEDICAL JURISPRUDENCE:**—Highest, National Medical University and Hospital, Illinois, 775 hours; lowest, College of Medicine, Syracuse University, 4 hours. Average, 36 hours.

**GENITO-URINARY:**—Highest, Barnes Medical College, 448 hours; lowest, Melharry Medical College, 4 hours. Average, 74 hours.

**GRAND TOTALS:**—Highest, Atlanta College of Physicians and Surgeons, 10,124 hours; lowest, Physio-Medical College of Texas, 958 hours. Average, 4,257 hours.

**AVERAGE NUMBER OF MONTHS:**—Seven plus.

assigned us, and this I believe will be best accomplished by teaching Ophthalmology, not as a specialty, but as an important and necessary part of a general medical education. I do not believe that one man in fifty, in this society of so-called specialists, had, previous to the time of his graduation, decided upon the special line of work that he is now following, and even had the large proportion of the men decided to enter special practice immediately after graduation, they would nevertheless have needed training in the general principles of other branches than their own. For this reason my endeavor is to teach in the undergraduate course only such subjects as are of interest to the practitioner of general medicine.

The method of teaching must be individual; no one can succeed by another's plan, and each must choose the method best suited to his own peculiarities and abilities.

The scheme of instruction which I personally attempt to carry out consists of clinical instruction which is given by the chief of clinic and of my didactic lecture. I fully realize the importance of clinical work, but I find that patients in the amphitheatre, during the lecture hour, divert the attention of the students, and it is not possible to allow a large body of men to personally examine cases during the lecture without confusion.

In the didactic lectures I set before myself the task of teaching the students to divide the cases, which they shall be called upon to treat, into two classes, one consisting of those that can be safely and properly handled, without special knowledge or special apparatus, the other those serious and dangerous cases, in which they should obtain expert assistance at once, and if this is impossible, to instruct them in such first aid as may be necessary, until the assistance of a specialist can be obtained.

As far as possible, the technicalities and such terms as are peculiar to our branch are omitted, and at the conclusion of the lecture the students are given slips with the explanation of the technical terms used in the day's lecture, with a summary of the more important points treated.

It is not so long since I, myself, sat upon the benches that I have forgotten the lectures on special subjects from which I suffered in my college days, and I then promised myself, should I ever be called upon to instruct a medical class, that I should earnestly endeavor to say what I wanted to teach the students in a language which they could understand. We should talk down to the level of the average student, and it is useless to attempt to teach too much.



My lecture hour is on Friday afternoon, and the men are tired with a hard week's work, and I realize the inability of the human mind, in such a condition, to retain an hour's lecture which is all meat. At the end of the hour the students will know more, if you have repeated yourself and have told them the more important facts in several different forms, and have clinched these facts by illustrations.

The selection of the essentials for the course of instruction is a matter again largely of personal judgment, and the things omitted are quite as important as the things taught. My own theory is that such facts as are plainly stated in all text books on the eye, and that can be learned by the student as well at home as in the lecture room, should be omitted. I consider it a waste of valuable time to teach any subject as I have frequently heard anatomy taught. A lecturer who stands before his class and simply repeats page after page from a text book is wasting his own and the student's time. I do not wish the student to learn the use of the ophthalmoscope save only for the detection of foreign bodies and opacities of the lens. Granted that a student should become expert enough in the use of the ophthalmoscope to be able to obtain some assistance from it at the time of his graduation, the chances are largely against his having sufficient opportunities in general practice to keep himself up to the standard which he had at first obtained, and the ophthalmoscope in the hands of a man who knows just a little about its use, is a dangerous instrument.

The points which I especially strive to impress upon the student are, the assistance that he may expect from an examination of the eye in forming a general diagnosis;—the necessity for recognizing ocular disorders as a factor in the causation of general disease;—the systemic causation of many diseases of the eye, with an insistent reiteration of the symptoms of those diseases requiring prompt and efficient treatment for the preservation of vision;—the importance of a routine examination of all cases;—and the necessity of the ability to detect and remove foreign bodies;—to recognize contagious diseases of the conjunctiva are insisted upon, and special stress is laid on the prevention of ophthalmia-neonatorum;—the differential diagnosis of conjunctivitis and iritis;—the use and dangers of atropia;—the prodromal symptoms of glaucoma;—the dangers of sympathetic ophthalmia,—and the duty of the physician in the prevention of such diseases as interstitial keratitis, and the other lesions of inherited syphilis.

Such vital matters as these I try to impress upon the men until they can never forget them, if they would. Optics and refraction are only taught in outline, and with a view of enabling a man to understandingly instruct his clients in the care of their own and their children's eyes. The prevention of myopia and the correction of squint by glasses and the proper position for study and other points of ocular hygiene are briefly mentioned. In brief, my endeavor is to equip a student to be a competent medical adviser to his clients and competent to practice the most important branch of our profession, namely, preventive medicine.

#### DISCUSSION.

Dr. Jackson (Denver): It seems to me that Dr. Alleman has brought to us, in the effectiveness of military organization, an excellent illustration. He insists that in order to attain success we must have mutual confidence in each other. It was the lack of that confidence more than any other one thing that was illustrated in Dr. Spalding's paper. The latter shows us things as they are, and Dr. Alleman shows us why they are so. The mutual confidence and ability to act together is not founded on the fact that every man in the army is exactly like all the others, and that each will do exactly the same thing, and strike at the same point. It is founded on the fact that each man believes that every other man will do his duty. It often lies in another direction, but he will do his duty. Mutual confidence in the medical profession will only come when we realize something of that same fact; when the practitioner of internal medicine knows the oculist knows ophthalmology as the former knows internal medicine. That confidence is not bred by an undergraduate course which trains the whole body of students for internal medicine; it would not be bred by a course that trained them all for ophthalmologists. The undergraduate course in medicine must give all a firm common foundation, and also start them in the special direction they intend to go. An undergraduate medical school does not train men as ophthalmologists. One does not need to cite 500 hours of internal medicine, and 100 of ophthalmology to show this. The whole medical course must be reorganized to meet new conditions. There was a time when all were general practitioners. Now we might be designated as general practitioners and specialists. But there will come a time when all will be specialists, where the population is condensed enough. It will not be a generation until it is generally recognized that medicine is a group of specialties, and the medical education that will prepare men

for their work will be the education that fits them to be specialists in one direction or another. If medical education is to consist of 500 hours of medicine and 100 hours of ophthalmology, the latter will be taught outside of medical schools, and the probability is it will be separated from medical practice. Either better schools will spring up than the present cheap opticians' schools, or something else that is not now in sight will develop to train men in ophthalmology. I believe what I urged last year is the best solution of the problem.

Dr. Baker (Cleveland): I read a paper some years ago at the Saratoga meeting of the A. M. A. on the same subject. I called attention to the mistake of confusing the medical student of today with the student of former times. I recall ten or fifteen years ago having had students under my instruction for two or three months, whom I am satisfied never saw an optic disc. At the present time we have youths entering medical colleges already educated in physics, biology and chemistry, and when they come to us they have spent two or three additional years in laboratory work and the use of the microscope. They have trained eyes and ears and hands and minds, such as Dr. Alleman and I never knew when we were medical students. I have seen these trained men the first time an ophthalmoscope was put in their hands sit down and make a creditable drawing of the fundus. When you say these men cannot use the ophthalmoscope to some advantage in their future life, I do not believe it. These men can and should be taught the use of the ophthalmoscope. If you show a case of retinitis albumenurica to that man he will remember it all his life. If through lack of practice or experience he does not have confidence in his own skill to make such examinations, he will at least know enough to send the patient where he can get such services.

Dr. Alleman (closing discussion): As I have said, we have got to consider the average, not the brainy, student; and I ask you, is not the average man apt to mistake opaque nerve fibres (for example) for albuminuric retinitis? That retinal changes are due to systemic disease he ought to know, and if he does he will obtain the aid of an expert to assist him in making a diagnosis of the general condition. Personally, I would not attempt to make a diagnosis of a neoplasm by the microscope. I would not take out an eye on my own diagnosis, even if I could recognize the different neoplasms with reasonable certainty. I would call in an expert. I think the ophthalmoscope should be used only

by the man who has the greatest opportunity to become expert in its use. The average man does not want to know all the specialties.

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## NOTE ON THE MEASUREMENT OF TORSION.

By LUCIEN HOWE, M.D.

BUFFALO.

It is well known that in the act of comfortable binocular vision at the near point there are three principal factors which enter into the problem. These are accommodation, convergence and torsion. In our ordinary clinical work we are accustomed to examine with a certain degree of care, at least, the manner in which accommodation and convergence take place in the individual before us. There are few practitioners, however, who give much attention to the torsion which the globe undergoes. Moreover, a very considerable number of ophthalmologists seem to know nothing about torsion, and care less concerning it. It is probable, however, that this movement, which every normal eye undergoes, is also of some clinical importance. It seems worth while, therefore, to ask ourselves how this can be measured.

The first measurements were made by an instrument suggested by Hering, or by some modification of it. That can be found in the older text books, for example, in the first edition of Graefe's *Saemisch*, Volume VI, page 661. Donders used an arrangement which he called an isoscope. A description and figure of it can be found in Graefe's *Archives*, Volume XV, page 1. A rather more recent method of measuring torsion was suggested by Le Conte, and is found in his book on "Sight," although his more elaborate article is in the *American Journal of Science and Art*, second series, page 453. The instrument to which I would call attention is based on a principle somewhat similar to that of Le Conte's. His plan was to draw a series of parallel vertical lines, placing these on a card before one eye. Another series of similar parallel vertical lines was placed before the other eye. Then, tipping the cards with the lines at a certain angle, and at the same time making convergence to a given point between the eyes and the cards, he would ascertain at what angle it was necessary to tip these cards, in order to make the lines appear vertical. The angle which the two cards then make with each other, evidently represents the amount which the vertical axes of the two eyes have actually tipped away from the vertical position.

As the plan adopted by Le Conte was tedious, it was found convenient to prepare a mechanical arrangement with which to assist in this, and by which the angle could be measured more exactly. It was this arrangement of the lines on the cards which the writer designed to demonstrate. The description of this is almost meaningless, without proper illustration. Those who are interested in the subject will find it described in detail in the first volume of a work on the "Ocular Muscles," now in press by Putnam's Sons.

Briefly stated, it is as follows: On a white card which measures about fifteen centimetres square, black vertical lines are drawn. On another card the same size, but of black paper, white vertical lines are drawn the same distance from each other as are the black lines on the white card. These two cards are attached to the lower side of a thin band of steel, and this band is fixed to a horizontal bar in such a way that when the band of steel is relaxed the lines on the two cards are then perfectly vertical. But when the steel band is bent, the two cards and the lines are inclined upward, making an angle below like the letter A. The angle which these cards include, show the amount of convergence which the eye undergoes. This description is evidently unsatisfactory, and especially so without a table showing what the normal amount of torsion is, with each meter angle of convergence in the horizontal plane, and in planes which lie above or below the horizontal. The discussion of that question, however, is foreign to this description. This is simply to call attention to the fact that it is impossible to measure torsion with a very simple mechanical device. That, and other means for measuring it, and also the amount of torsion which the eye undergoes under various conditions, are described in the first volume of the work on the muscles just referred to.

#### DISCUSSION.

Dr. Valk (New York): I have been very much interested in Dr. Howe's demonstration, and shall be glad to read his paper. At the same time, I cannot help asking myself the question, What of it? I am not satisfied with the importance of this condition, and I hope Dr. Howe will bring it out. You are all familiar with what torsion is, and the question comes up, how much influence has it on the daily walk of life. It is a very beautiful subject, scientifically, and I like some times to lie in bed and try to study the after images of the retina in the morning, in reference to the tipping in the periphery of the field. Dr. Howe has brought out the point that in investigating cyclophoria to always have the figures at right angles to the line of sight. Another point that comes up

is the fusion force of the eye in regard to vertical lines. I trust he will explain this matter to me, as we bring about fusion and binocular vision by divergence. If you take two almost vertical lines, or lines slightly inclined toward each other, say 5 degrees, and look at them in this way (illustrating) until you get the periscopic effect, it is found that the lines in the stereoscopic picture are perfectly parallel and vertical. There seems to be some power in the retina to fuse or blend these vertical lines, without the images being on exactly corresponding parts. It seems to be a psychological phenomenon, and I know of no other way to explain it. The fact of there being such a condition as cyclophoria I doubt. We may have a cyclotropia as a pathological condition. If we have a paralysis of the superior oblique, that will give a tipping of one image, but I do not believe in the theory of cyclophoria, unless you have a paresis. I saw a case the other day in which such a diagnosis had been made, and in examination with the tropometer it was proved to be a paralysis of the third nerve. As I said, I have no experience with this condition of cyclophoria. I have never come across a case, but Stevens is working along the same line, and he thinks now that the condition of heterophoria is due to cyclophoria. I have tried over and over again, with one test and others, and yet I have seen no cases of cyclophoria. I think there is a physiological function which entirely corrects the position of vertical meridians, unless there is a paralysis of the superior or the inferior oblique. Yet if I uphold my anatomical theory, if we can have a muscle too strong or too weak, then I can see no reason why a superior oblique may be too weak, and in this way it should produce a cyclophoria. I trust that when I have the pleasure and profit of reading Dr. Howe's paper I shall be convinced of the error of my ways.

Dr. Howe (closing): What I was speaking of was the tipping, which the axes made. The doctor asks what is the use of these tests. I will mention simply one. When we ask the patient to look at the dial for correction of astigmatism, that dial is in the distance, and we correct the astigmatism with the axes vertically adjusted for the distance. When the patient looks at a near point the vertical axis will be wrong. For the higher degrees of convergence it does make a difference, whether or not torsion is taken into account.

## REPORT OF A CASE OF DIABETIC MYOPIA.

BY JOHN E. WEEKS, M. D.,

NEW YORK.

The report of the following case is of interest because of its rarity.

The patient, Dr. John H. S., aged 52 years, consulted me on October 3, 1901, regarding his refraction. At that time the refraction was

R.  $+0.125$   
L.  $+0.25 \text{C} - 0.5$  axis  $10^\circ$

The refraction remained virtually the same until January 1, 1905, when the patient observed that objects at a distance were somewhat blurred, and it became necessary for him to hold his book closer to the eyes than had been the case previously.

The patient was suffering from a chronic affection of the face of a specific nature, which had recently taken on activity, and this, accompanied by other troubles, had caused him excessive worryment. About the first of January he noticed that the amount of urine voided was large in amount, but paid no particular attention to it.

The vision gradually became less acute for distance until on February 5 he was scarcely able to recognize the features of acquaintances beyond 10 or 12 feet. The polyuria had also increased. On measuring the quantity of urine, it was found that he was passing from 134 to 150 ounces in twenty-four hours, and that the percentage of glucose was 2.7, about 3.75 ounces (112.5 grams).

The patient came to me on February 18, because of the increased dimness of vision for distance. At this time the refraction was

R.  $-0.62 \text{C} - 0.5$  axis  $90^\circ$   
L.  $-0.5 \text{C} - 0.75$  axis  $40^\circ$

With this correction the vision was  $20/20$  in each eye. Glasses were prescribed after the above formula. The presbyopia, which was 2.5 D., had not increased. There was no appreciable change in the interior of the eyes.

On February 16 the patient began a rigid diet and commenced taking half a grain of codeia every three hours.

On February 23, four days after the glasses prescribed had been obtained, the patient returned to the office with the statement that his glasses for close work were not quite strong enough.

On February 26 the patient stated that his sight for distance had returned, and that he was no longer in need of the glasses for distance vision. The refraction at this time was

$$\begin{array}{ll} \text{R.} & +0.25 \text{C} +0.25 \text{ axis } 5^\circ \quad \text{V.} = \frac{20}{20} \\ \text{L.} & +0.5 \text{ axis } 145^\circ \quad \text{V.} = \frac{20}{20} \end{array}$$

On February 26 the amount of urine voided in twenty-four hours was 52 ounces, and the percentage of glucose was 3.5, about 1.8 ounces (54.6 grams).

March 10. Patient still dieting; amount of urine voided in twenty-four hours, 48 to 50 ounces; the amount of glucose not enough to determine percentage. The refraction remained hyperopic.

June 25. Patient is in good health; little or no glycosuria. The refraction is as when the eyes were last examined.

The case is one of rapidly-acquired myopia, affecting both eyes. The degree of myopia developed was approximately one and a quarter dioptries in each eye, and the astigmatism was increased one-fourth dioptrie, with slight change of axis.

The time that elapsed from the onset to the complete disappearance of the myopia was about two months.

Hirschberg (*Centralbl. f. Aug.*, 1886 and 1891) reports three cases, occurring in patients 63, 52 and 50 years of age. All had acquired myopia rapidly and all had good vision with the correction.

Cases are reported by Appenzeller (*Centralbl. f. p. Augen.*, XX., 1896, p. 139).

In Grimsdale's case (*Brit. Med. Jour.*, Feb. 4, 1890) the myopia developed was two dioptries; it disappeared in ten days.

Risley (*Trans. Amer. Ophth. Soc.*, 1897, p. 121) reports two cases. In the first case the lessening of the hypermetropia (increase in the refraction of the eye) apparently reached 3.75 D. in one eye and 4.5 D. in the other. No recession in the myopia was observed. In the second case a greater degree of hypermetropia was developed in a diabetic patient of 74 years during a period of recession in the amount of sugar excreted in the urine, and the former degree of hypermetropia was re-established on return to the former amount of sugar excreted.

Other disturbances of refraction occur. Horner (*Klin. Monats. f. Augen.*, 1873, p. 490) reports a case of acquired hypermetropia in a patient of 53 years. Treatment of the diabetes reduced the hypermetropia by two dioptries. This case appears to be unique. It is difficult to account for the development of



hypermetropia in diabetes mellitus. All of the conditions make for an increase rather than a decrease in the refractive index of the media of the eye.

Schmidt-Rimpler (*Graefe-Saemisch Handbuch*, Bd. XI., T. 1, p. 388) examined the range of accommodation in 80 diabetics and found 14 per cent with diminished range of accommodation. The effect on the range of accommodation varied from one dioptre to nine dioptres, the last in a person of 16 years.

All writers are agreed that the increase in the refraction of the eye is due to an increase in the index of refraction of the lens as a result of the presence of sugar in the fluids of the eye.

#### DISCUSSION.

Dr. Jackson (Denver): Cases such as Dr. Weeks has reported are so rare that I think none of us can draw conclusions from individual experience, and perhaps we are not yet in a position to draw conclusions from all the collected cases. Dr. Weeks' explanation is a good one, and applies to cases where increase in myopia is clearly coincident with increase in the amount of sugar in the urine and increase in the discharge of urine; and yet that these conditions are directly connected has not been demonstrated in any of these cases. It is merely a probability—a supposition—and in the light of Horner's case and one I put on record now, there must also be some other explanation.

Mrs. B., aged 52, came with a history of diabetes lasting several years. Recently the amount of sugar had been largely increased and her general condition was worse. Until a few weeks before distant vision had been good, and there had been no trouble other than normal presbyopia. Then her vision went down to  $\frac{4}{60}$ . She complained of polyopia, saw three moons, and the electric lights appeared broken up, some of the lights being red. With R. & L. plus 2.25 sph. vision of  $\frac{4}{4}$  was obtained. These lenses were prescribed for distance, and for near work she was given R. & L. plus 4.25 sph. For a little time they served her very well. Three months later she returned, complaining that she could not see with the distance glasses, and could not use the near glasses for reading. Vision without any glasses was now  $\frac{4}{4}$  plus. The same was obtained with R. plus 0.50; L. plus 0.62. She was given R. & L. plus 2.75 sph. for near work only. Six weeks later she was using these satisfactorily, and her eyes were unchanged in refraction. Her general condition rapidly grew worse and she died within a few months, without any other marked change in refraction. I would say that a satisfac-

tory explanation of these sudden changes in refraction in diabetic patients has not yet been made.

Dr. Weeks (closing discussion): I am much indebted to Dr. Jackson for the presentation of this case, and would like to ask him if the amount of sugar in the urine diminished at all during the period that he observed the patient?

Dr. Jackson: Not materially. The amount of sugar was never very great, according to my recollection—3 to 5 per cent—varying from day to day, or week to week all the time. The patient grew worse just before the hyperopia appeared. The tension of the anterior chamber was normal throughout.

Dr. Weeks: It is possible that some other cause was at work to produce the condition of the eyes in this case.

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## THE MECHANISM OF ACCOMMODATION AND ASTIGMATIC ACCOMMODATION.

BY EDWARD JACKSON, M. D.,

DENVER.

Porterfield<sup>1</sup>, one hundred and fifty years ago, wrote thus in the opening of his chapter on "The Crystalline Humor": "From its solidity and transparency the ancients concluded that it was nothing but a thick, congealed humor. But though it be commonly called a humor, it is really made up of solid parts." Then he goes on to describe the "many thin spherical laminæ, or plates lying within each other," and the fibres composing these, which had recently been described by Leeuwenhoek.

Cramer<sup>2</sup>, Helmholtz<sup>3</sup> and Knapp<sup>4</sup>, occupied with proving that the lens changed its shape during accommodation; that the change was such as would produce increased refraction; and that the extent of the change in the lens surfaces corresponded to the amount of the accommodation, apparently gave little attention to the exact mechanical factors upon which this alteration of form depended. Helmholtz suggested a plausible explanation might be found in the tendency of a uniform elastic bag containing fluid, to assume a spherical form when released from external pressure. When the zonule was relaxed the lens might become more nearly globular. Such a possible change has been largely accepted as an established fact, or at least as an essential portion of the Helmholtz theory, which regards accommodation as produced by relaxation of the zonule.

The fact pointed out by Porterfield that the lens is not a humor, but, "is really made up of solid parts," had been so lost sight of that Tscherning<sup>5</sup>, in clearing the ground for his own theory of accommodation, having demonstrated "that accommodation is effected by the temporary formation of an anterior lenticonus," goes on to say, "the hypothesis of Helmholtz does not seem tenable; for it is not easy to conceive how such a mechanism could produce a flattening of certain parts of the crystalline lens and at the same time an increase of curvature of the other parts." Priestley Smith,<sup>6</sup> however, has pointed out that the lens might easily be so constructed that the changes of form during accommodation observed by Tscherning, would take place during relaxation of the zonule.

I believe that the evidence we now possess on the subject indicates that the changes in the form of the crystalline lens during accommodation depend upon the peculiar structure of the lens, rather than upon any peculiar sort of stress to which the lens is subjected through the zonule.

An elastic capsule containing fluid may assume different forms, dependent upon the degree of tension applied to it, and the direction or manner of its application. Its form will depend not at all upon the fluid contained, but upon the qualities of the capsule and the stress to which it is subjected. On the other hand, an elastic substance, such as the lens is, will change in form under any stress put upon it, but with the release from stress will tend to return to the special form determined by its own peculiar structure.

Priestley Smith<sup>6</sup> closely imitated the change of outline observed by Tscherning, by using concentric springs of steel. A modification of his arrangement, conforming to the lens changes observed during accommodation by Grossman<sup>7</sup>, is represented in Fig. 1. Under stress by traction in the direction of the zonule, the outline becomes that shown by the broken lines, similar to that of the lens with the accommodation in abeyance. But upon relief from the stress, the form assumed is rather that of the solid lines. Think of the innumerable forms of metal spring, or of India rubber articles with which we are familiar. Under stress any of these things will change its form; but upon being relieved from outside tension or pressure, it immediately resumes the form determined by its original constitution and structure. That Tscherning found it hard to conceive how lenticonus should develop under relaxation of the zonule, shows that he lost sight of the fact that the lens is really an elastic body, tending to assume

a shape of its own, that he thought of it as entirely passive, under influences exerted on it from without. Remembering, then, the character of the lens, no outside stress whatever is necessary to account for any possible shape that it may take during accommodation.

As to the general changes in the form of the lens during accommodation, there is now little room for doubt. The measurements of images formed by reflection from the anterior surface of the lens, that have been made by Tscherning and his pupils, and by others, conclusively demonstrate the formation of anterior lenticonus during accommodation. Grossman, in his favorable case, has demonstrated that increased conicity of the posterior lens surface also occurs. These changes perfectly explain the greater increase of refraction at the center of the pupil,

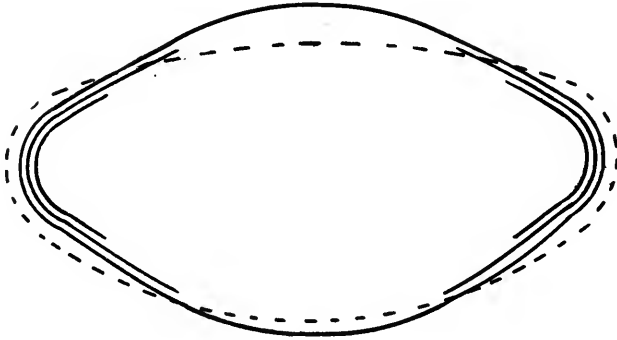


FIG. 1.

as compared with the margin; which had been observed subjectively by Thomas Young<sup>8</sup>, and others who have repeated his experiments, and which are fully confirmed and shown to be generally true by study of the changes produced by accommodation in the skiascopic play of light and shadow. It is thoroughly established that during accommodation the increase of refraction is greatest at the centre of the pupil; although in the great majority of eyes, some increase is shown in all parts of the pupillary area.

What the changes of refraction in the different parts of the pupil usually are, I have tried to ascertain by skiascopy, by comparing the aberration exhibited in the pupil as studied by skiascopy without the use of a cycloplegic; first, with the accommodation relaxed by the use of convex lens; and, second, with the accommodation exerted to see clearly a small object held close before the eyes. In the former case the aberration was usually posi-

tive; in the latter it was usually negative. The accompanying table summarizes the observations made in 36 cases.

In the table the second column indicates the sex, the third the age of the patient. The fourth shows the increased refraction at the center of the pupil to see clearly the object fixed; that is, the amount of accommodation exerted. When this accommodation was exerted, however, the refraction at the edge of the pupil had only increased by the amount shown in the fifth column; the difference between the center of the pupil and edge being given in the sixth column, headed deficiency of accommodation at edge of pupil.

TABLE.

	Sex	Age	A. at centre	A. at edge	Deficiency
1.	F.	11	5	3.75	1.25
2.	F.	11	4	3.50	0.50
3.	F.	14	7	4.	3.25
4.	M.	15	5	3.50	1.50
5.	F.	17	3	2.	1.
6.	F.	18	4	2.50	1.50
7.	F.	18	5	3.50	1.50
8.	F.	20	3	1.75	1.25
9.	F.	21	4	1.50	2.50
10.	F.	21	3	2.	1.
11.	M.	22	3	1.75	1.25
12.	M.	23	3	1.75	1.25
13.	M.	23	3	2.75	0.75
14.	F.	24	3	2.50	0.50
15.	M.	25	5	3.25	1.75
16.	F.	26	5	4.25	0.75
17.	F.	26	5	4.25	0.75
18.	F.	28	5	3.75	1.25
19.	M.	28	3	2.	1.
20.	F.	28	4	3.	1.
21.	M.	30	3	2.	1.
22.	F.	30	3	22.50	0.50
23.	F.	30	4	2.25	1.75
24.	M.	32	3	2.	1.
25.	F.	32	5	3.50	1.50
26.	M.	32	5	2.50	2.50
27.	F.	32	4	3.	1.
28.	F.	33	3.50	1.25	2.25
29.	M.	33	3	2.	1.
30.	M.	35	4	1.75	2.25
31.	F.	36	4	1.50	2.50
32.	M.	37	4	2.75	1.25
33.	F.	37	3	2.75	0.25
34.	F.	38	4	2.	2.
35.	F.	40	3	2.50	0.50
36.	M.	45	2.50	2.50	Trace

Thus, in the first case, when the accommodation was relaxed there appeared a positive aberration of 0.25 D., the edge of the pupil being that amount more myopic than the center. When, however, the eyes were fixed on a point 8 inches from them, exerting 5 D. of accommodation, and giving the point of reversal for the center of the pupil at 8 inches, the edge of the pupil was found to have its point of reversal at about 10 inches, making it 1 D. less myopic than the center, negative aberration 1 D. The increase of refraction at the center had been 5 D., at the edge 3.75 D., and the difference 1.25 D., the deficiency of accommodation at the edge of the pupil was the change in aberration.

The size of the pupil varied in different cases, but in all it was the normal size of the pupil attending the given conditions of accommodation and convergence in the dark room. On this account these observations are of more practical importance than changes that might be noted in a pupil of fixed diameter; since the latter would vary greatly in significance for different eyes.

In all cases the increase of refraction was greater at the center of the pupil than at the margin; but the deficiency of accommodation at the margin varied widely. In case 36 it was a mere trace—less than one-quarter dioptré. In case 31 it was 2.50 D. or five-eighths of the whole 4 D. of accommodation exerted. In case 3 it was 3.25 D. The most striking fact brought out by the table is this wide variability in the deficiency. The same variability is shown in the smaller number of cases reported by Tscherning, in which the accommodation was measured subjectively by the method of Thomas Young.

But far more striking than anything that can be reduced to statistical form are the irregular and indescribable variations in the distribution of light and shadow in the pupil, that are found to attend accommodation. In the early days of the shadow-test Forbes<sup>9</sup> called attention to the variations in the shadows seen by it, and ten years ago<sup>10</sup> I pointed out that these variations were individual, and so numerous and peculiar to the particular eye that nothing except an understanding of the general optical principles which determined them could render them comprehensible. The changes in the forms of the light and shadow in the pupil produced by accommodation are equally varied. In brief, the changes in the refractive condition of the lens which are produced by accommodation are individual peculiarities which vary within very wide limits. These variations of light and shadow noticed with skiascopy are significant of defects in refraction that fall under the general head of irregular astigmatism, with which it

is generally the case that a certain amount of regular astigmatism is found.

Grossman, studying the changes of eserine-accommodation in the eyes of the cat, found during accommodation a high degree of regular astigmatism; corrected in this case by the narrowing of the slit-like pupil, as Lindsay Johnson found such astigmatism corrected in the eyes of the seal. When, however, the accommodation was relaxed by atropine, a large part of this astigmatism disappeared under the tension of the capsule. In these observations we have the most definite and positive evidences of astigmatic accommodation, and of changes in its amount and direction attending the accommodative changes which are equivalent to the effects of spherical lenses.

Let us turn to the structure of the crystalline lens and its bearing on accommodation in general for an explanation of these observations. The general course of the lens fibres is represented in Fig. 2. Each is a bent elastic body. Under tension of the

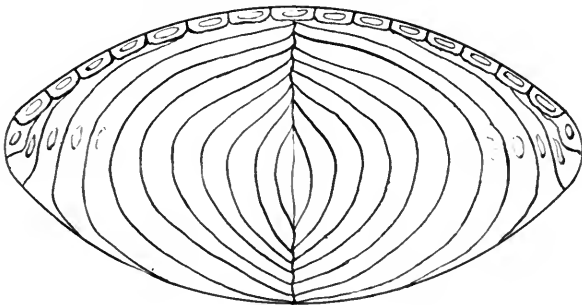


FIG. 2.

zonule and capsule its ends are brought nearer together, like a bow when the string is drawn upon; and the lens, as a whole, is flattened and rendered thinner. When the tension of the zonule is relaxed the ends of each fibre tend to separate like the ends of a bow released from the tension of its string; and the lens as a whole becomes thicker. If all the fibres composing each concentric layer of the lens are of the same shape and structure, of equal strength and elasticity; the changes in the shape of the lens, and the consequent changes in its refraction, will be symmetrical with reference to the axis of the lens. If the fibres differ in form or structure, are of unequal strength or elasticity, the changes in form or refractive power of the lens as a whole will be asymmetrical. Fig. 3 represents a model of the kind shown in Fig. 1, but having springs of unequal strength on the two sides.

Under tension it may become symmetrical, assuming the form indicated by the broken line. But released from tension it at once assumes an asymmetrical form indicated by the solid lines; which form is dependent on its inherent structure. Such asymmetry irregularly distributed or confined to the adjoining fibres of one sector of the lens would cause irregular astigmatism. But if confined to the fibres of two sectors opposed to one another, as compared to the fibres disposed at right angles to these, it would cause regular astigmatism. Such an explanation of astigmatic accommodation, or accommodative astigmatism seems to me more simple and rational than the supposition of asymmetric changes produced in a lens of uniform elasticity by asymmetric tension of the zonule.

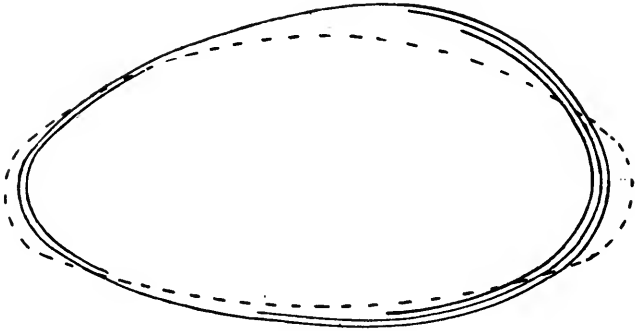


FIG. 3.

As I have observed changes in astigmatism attending changes in accommodation, these are better explained by the mechanism here suggested, than by that of unequal tension of different parts of the zonule. However, the latter need not be regarded as impossible, although certain inherent difficulties may render it improbable. The ciliary muscle is composed of unstriated muscle cells. Continuous layers of such cells elsewhere, as in the intestinal canal may contract and relax in segments. But it is very uncertain whether such segmental activity ever arises from anything but immediate local stimulation. To suppose that in the ciliary muscle it arises in response to so distant an impulse as a reflex to blurring of the retinal image, that it is directly compensatory for the defect of the individual eye, is a bold assumption. Although the ciliary muscle is generally described as consisting of two parts, one composed of radiating and the other of circular fibres, these two are intimately blended together. Fibres at first radial blend and become a part of the circular group; or they



may be traced fairly from the circular into radiating fibres. The existence of circular fibres at all is a grave difficulty to the supposition of partial contraction of the ciliary muscle, except in response to absolutely local causes. It is difficult to conceive how in a continuous mass of unstriated fibres, placed end to end and intimately intermingled, one portion can contract, while a part continuous therewith remains relatively relaxed. I do not forget that asymmetric action is reported by Brandes<sup>11</sup> to have been produced by eserine, and partial paralysis by homatropine; but this was by a strictly local action of the drug, something totally different from partial response to a central nerve impulse.

The supposition that accommodative changes in astigmatism depend upon their peculiarities, gives a new interest to the arrangements of the lens fibres. Bowman<sup>12</sup> pointed out that the primitive arrangement observed in the lower animals seemed to be one in which all the fibres started from the antero-posterior axis of the lens and returned to that axis. An advance on this was the arrangement in which all the fibres started from one axial plane, in the anterior part of the lens, and meet in a second plane at right angles to the first, in the posterior half of the lens. In higher types of animals the arrangement becomes still more complex. What may be termed the planes of origin and insertion of the lens fibres become progressively more numerous, until in man they consist of radiating planes that branch repeatedly, giving an arrangement of fibres admirably adapted to overcome and neutralize the inequalities of individual cell development. Bowman wrote of these fibres more than fifty years ago, when he believed that the power of accommodation depended not on change in the shape of the lens, but upon its displacement forward by the contraction of the ciliary muscle. Yet with regard to this structure of the lens he used these words (page 67): "It certainly appears to me that the expansion of the axis into the planes now described, and the complexity of the arrangement of the fibrous constituents of the lens, are designed to furnish the mechanical means of modifying the curvature of the surface of the lens."

To recapitulate: 1. Accommodation and the optical changes coincident with it depend on the inherent elasticity and structure of the crystalline—its tendency to assume its individual shape when freed from the tension of its capsule.

2. Accommodative changes in astigmatism are mostly due to asymmetry in the strength, elasticity, or arrangement of the lens fibres; although it is possible that they sometimes arise from asymmetrical tension of the zonule.

If these explanations are correct, they have very practical bearings on the correction of ametropia. The correction of hyperopia, putting an end to accommodation for distant vision, should be accompanied by the accurate correction of the astigmatism which exists with relaxed accommodation, and complete correction of astigmatism may only be possible after complete relaxation of accommodation. In exceptional cases the best optical correction for the eyes may include a cylinder for near work different from that acquired for distant vision. But this would only be very exceptionally for eyes using a large amount of accommodation; and the difficulty might often be best met by something of a compromise in the cylindric component of the correction.

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#### DISCUSSION.

Dr. Schneideman (Philadelphia): There is no doubt that the degree of the astigmatism, and even the axis changes, in some cases, as the eye alters its adaptation from its punctum remotum to its punctum proximum. This change has heretofore been generally ascribed to partial contraction of the ciliary muscle, leading to unsymmetrical changes in the lens. This explanation is now believed in many quarters to be incorrect. It is at least not proven. In Grossman's case of aniridia with polar cataract, certain unexpected movements of the lens were observed during accommodation, and these may have something to do with the phenomenon.

Writers upon the mechanism of accommodation consider the lens to be simply a semifluid body in an elastic capsule. In the mechanism of accommodation the elastic capsule is everything.

No attention is paid to what Dr. Jackson points out, the structure of the lens itself with its arrangement of fibres. These of various strengths, shapes and positions, he compares to elastic springs, which, when released from tension, may well play an important part in the particular shape the lens is to assume during accommodation. The resultant of all these forces may account for the anterior lenticonus developed during accommodation, as well as for a certain amount of astigmatic effect.

It is not likely that nature would go to the trouble of perfecting a complicated system of fibres, such as the lens consists of, if they had no function. And the function of the lens is, of course, that of accommodation.

Dr. Fridenberg (New York): I would call attention to an article by Grossman, of Liverpool. Dr. Lewis, in his paper, likened the accommodation to the rapidly moving river, the motion invisible until it meets some obstruction. Grossman reports a congenital lesion in the iris of both eyes, with a small spot on the anterior and posterior capsule. One could hardly imagine a better arrangement for the observation of accommodation than this, and it was carefully studied with the retinoscope and ophthalmometer. The conclusion was that there is an increase in the refractive power of the lens, and a decrease in diameter, the anterior surface moves forward and the posterior backward. The ring is narrowed and the ciliary processes approach the visual axes of the eye. There is decided elasticity of the capsule. The whole lens trembled whenever the accommodation was exerted, and this showed there was no tension of the capsule, as claimed. He claims it is incorrect to draw conclusions from traction on an extracted lens. The experiment is too gross. "We do not know in what direction we are exerting the force, and a difference of a few degrees in the angle of direction may produce different results. Another interesting point in Grossman's observations is regarding the accommodative change in astigmatism. He claims there is a side motion of the lens as a whole, and in this case he was able to see clearly the motion of the lens. Contrary to the general belief, there was trembling of the lens. He believes the change may be explained by this slight motion of the lens rather than by segmental contraction of the ciliary muscle.

Dr. Jackson (closing discussion): I think Grossman's work on his case has been the last thing needed to give us an understanding of the accommodation. It is certainly a valuable contribution to the literature of the subject. Bowman suggested the

significance of the lens structure in his lectures published fifty-six years ago. I do not think that any one who is at all familiar with the phenomena of living beings can conceive of an elaborate structure without some function, and the optical function of the lens seems to be its sole function, and it seems fitted to do this particular thing. The gap seems very slight in what we now know of accommodation. I would like at this time to refer to Dr. Lewis's paper. I think we cannot too strongly emphasize the connection between accommodation and the intraocular circulation. I think the explanation Dr. Lewis put forward the other day somewhat tentatively, we may not quite accept; but there is some intimate connection between the intraocular circulation in these large vascular spaces and the act of accommodation.

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## RELATIONS BETWEEN MEDICAL PRACTITIONERS AND SPECIALISTS IN DISEASES OF THE EYE.\*

BY JAMES A. SPALDING, M. D.,

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The composition of a paper on this important question would seem, at first glance, an easy task. The more, however, that it is studied, the more it abounds in difficulties asking loudly for a solution. All that we have to do, from one standpoint is to scold physicians for not immediately sending all of their patients with headache, or defective sight, or inflammations of the eye of any sort, to the oculists. We may also find serious fault with them for putting their names to petitions to the Legislatures, asking for laws to place uneducated opticians on a level, so far as eye examinations are concerned, with medical men who are as well educated as oculists are supposed to be. As the question is looked into deeper, we see chances for fault-finding on both sides. For, from another standpoint, if well educated oculists have the right to be seriously offended at the way in which they are neglected by many medical men in favor of opticians, there is another side to the story, to which your attention shall be called at once. In order that oculists may expect the support of physicians, generally, they must be decent, and ethical, and properly educated.

Many physicians, and people generally, have the right to complain of the way in which some oculists have behaved toward the

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\*For sake of brevity, I shall in this paper, call medical practitioners, Physicians, specialists in diseases of the eye, Oculists.

profession, the public, and even their fellow oculists; by demanding too frequent visits; by asking too large fees; by taking away patients and families from the practices of physicians; by acting like charlatans, and by sneering at the operative skill and refraction work of other men in the same line. How, for instance, can any physician recommend a patient to an oculist who will insist on daily visits for one year, under pretense of absorbing cataracts by instilling a lotion into the eyes, when that lotion, if of any use, could as well be instilled at home and an occasional visit for observation made? What can one's opinion be of an oculist who will invite into his place of practice, where good specialists abound, another man to operate on patients for pay during that foreigner's "vacation?" What can we think of the man who will accept such an invitation, when in so practising, he is actually taking from a tax-paying citizen fees that should be his? I am opposed to any inter-state licensure that goes beyond a consultation for the day and the hour and the operation, or a permanent change of States.

What opinion can any medical man have of an oculist who says in the hearing of a patient: "There, I don't see why he" meaning another oculist, "did not operate at once?" Yet everybody knows that some cases do better by no operation; and that others are made a great deal worse.

Or what can the physician think of an oculist who sneers at a brother oculist's lens-prescription, when he has known the axis of astigmatism in his own eyes to alter in a single night of hard work in an obstetric case?

Can any physician recommend to his patients as a safe man in diseases of the eyes one who, like the \$5-a-month-correspondence-method-quack tells a patient to drop into the eyes eighteen times daily, lotions from six different bottles, all containing the same indifferent solution? Or can he think well of that oculist who, on the plea of nasal obstruction as the cause of lachrymation, compels a patient to make daily visits for six months for use of a spray, when if of any use, that spray could be produced at home, part of the time? Would any physician like to be treated in such ways himself? What must we think of any oculist who permits an optician of today to advertise: "That he studied how to fit *lenses* for two years in the office of the eminent eye doctor of such and such a city!" Finally, would any physician recommend to his patients oculists of apparently good standing who advertise in the papers that "they take this method of informing the pro-

fession that they are making a specialty of the eye," when it is so easy to see that if they wished the profession *only* to know this fact, they could send out personal notices?

Asserting, now, that if oculists desire the support of physicians they must be ethical and decent men, I can proceed with a clear mind and argue in favor of well educated oculists who treat their fellows and the public honestly. For this is a burning question of today asking for decision. All around are oculists educated to do good work, yet deprived of patients by uneducated opticians. What is the cause, and is there any remedy? If we can solve these questions we can make it worth while for men to study the eye. If not, then the specialty as a means of making a living may as well cease; patients visiting the opticians for lenses, and the hospitals for operations. The man who expects to live in competition with these two antagonists must have his private hospital, with his own grinder of lenses.

The most important fault to find in the relations between physicians and oculists is the neglect, thoughtlessness, greed, inattention—call it what you will—by which any physician meeting with any inflammation of the eye fails to advise a consultation with an oculist. No one ignorant of the anatomy and diseases of the eyes has any right, in the neighborhood of skilled oculists, to have anything more to do with diseases of that organ, than an oculist has to treat a fracture or a fever. In each such separate instance, each man is ignorant. The proper physician should be summoned or the patient sent. This standpoint is so impregnable that it would seem useless to mention, yet but lately have I seen an eye lost from glaucoma because the physician did nothing. He said the eye would improve as the patient's health improved. Lately, again, I have seen a patient with iritis whom, the physician failing to help, was sent by him to an optician to see if lenses would not cure. Finally, it is a recent fact in my practice of removing from the corneae of three different patients, foreign bodies, for the removal of which these patients were recommended to an optician by a physician. Many are the attacks of iritis in which astringents have been used by physicians instead of atropia, with the resulting adhesions and diminution of sight. Rarely have I had cases of ophthalmia neonatorum referred to me by physicians until they were serious. How many physicians insist on treating eye diseases of which they know nothing, except as they study up in the text books? How many fit lenses imperfectly, without ever intending to do that delicate work perfectly?

But let me leave this section. There are exceptions which test the rule. Still, I have no patience with men who are half one thing and half another, except in towns where there are no oculists. There, they have their place, and should be encouraged to do *good* work.

No oculist that I ever heard of ever recommended any sick person to consult a druggist. Yet many physicians do this absurd thing when they send people with diseased or inflamed eyes to opticians!

What, now, is an optician?

A person who, seeing a chance to make a good living by the exercise of some ingenuity and the power of advertising "Eyes Tested Free," studies, after a fashion, at an optical institute, or often by the correspondence school method. In some schools he can get a diploma to test eyes after *talking two hours with the proprietor*. In others there is a course of from two weeks to six at the most. In these institutions instruction is of the most meagre form. Practical eyesight testing is slight. The use of the ophthalmometer is taught, but the pupils are always told to follow the axis so shown, when it is a fact that patients often accept a cylinder with an axis exactly opposite. Of the eye muscles and ophthalmoscope nothing is taught. With this slight outfit, without any knowledge of the anatomy of the eye, or the tests for colors, visual field, muscular imbalance, and so on, a man so taught becomes an optician, and enters into competition with men educated in diseases of the eyes. Present conditions point to the success of such men as likely to be permanent, owing to many reasons, but chiefly, as I believe, to the failure of physicians, as a whole, to advise at every opportunity the people to consult an oculist in preference to opticians.

What is an oculist?

I take it that a physician specializing in the eye, in order to deserve the patronage of the people and physicians, ought, as I have previously said, to be above reproach. He ought to have studied medicine for four years, to have had chances for clinical work in a hospital, and then have studied the eye thoroughly. I have always blamed, and I mean to blame to the end of my life, every oculist who signs his name to a six weeks' certificate of special study of the eyes. I can find some fault with those who sign certificates of three months' study. It would be better for every oculist to study an entire year, and to have had under his personal care, in an eye-hospital, at least one thousand patients before be-

ginning practice. Every oculist must see that if he wants to deserve support he must be well educated. How can he possibly compete with opticians unless he makes it plain to the public that he has studied more than they.

If you recall the hundreds of diseases of the eye it is plain that you cannot learn much about them in six weeks, to say nothing of learning how to test the sight besides, so as to do it better, *better*, I insist, than the opticians. They have but six weeks, at the most, in which to do this, yet many practicing oculists of today are willing to put their names to certificates asserting that in that short time a graduate in medicine can learn all about the eye and its diseases, besides learning how to test the eyesight as well as the opticians have done in the same brief time. Do you see the dilemma? If you do, then I say that this Association to which I am talking should speak in no uncertain terms, for the future, against any of its members signing similar deceptive certificates of insufficient instruction.

The eye is a part of the body, yet the testing of its functions has left the hands in which it belonged, namely those of educated medical men, and been granted by a vast majority of the people to those who know nothing about it. For, to test the central sight, alone, and so to decide about the condition of the eye, is as outrageously ridiculous as to feel the pulse and assert that the heart is normal, or to see a person pass a good full stream of water, and say that the kidneys are healthy. Yet no living person would seriously defend the diagnosis of cardiac or renal diseases from observations so nonsensical as these.

In the same line of thought, the eye contains in its function of sight many indications of the condition of the body totally ignored by opticians. With the ophthalmoscope we can diagnose many constitutional diseases. By the color sense we recognize more than black and white. By alterations in this sense we diagnose diseases of the retina and optic nerve. With the aid of the field of vision, we see not only straight ahead, but laterally, and so anticipate approaching danger. The measurement of the visual field warns us of optic nerve disease, or glaucoma, or of cerebral affections. The size of the pupils warns us of tabes. Finally, the condition of the eye muscles is most important. Few pairs of muscles are balanced, and there is no greater medical triumph than by the use of a minute prism to correct hyperphoria, and relieve a patient from innumerable troublesome nervous symptoms.



The term, eye sight, means, I repeat, a great deal of which most people are absolutely ignorant, the opticians as much so as the laity. I insist upon it, that the testing of the *entire* function of the eye, the central sight, the color sense, the field, the pupils, and the examination of the fundus of the eye is a medical study and a medical act. Any organ of the body which fails to perform the function for which it was created, is a diseased organ, and should be treated only by medical men. Any eye that has vision below normal, is a diseased eye, and should not only be examined and tested by medical men alone, but should, finally, be treated by them if they see fit, with proper lenses.

If people wish to be fools and to consult uneducated men we cannot help it. But it is a far-cry, from voluntarily consulting an optician, and the being directed to go to see one by any physician.

The test of the sight being, as I insist, a medical act, we cannot help wondering how it has fallen so largely into the hands of opticians, who, at their very best, are incapable, being uneducated, of properly deciding points of so immense importance to every person living. And here, I cannot help observing, how curious it is, that people will pay so largely for teeth to enable them to look passably well at an age when looks are of no concern, or greedily to swallow burdensome abominable boluses of meat, and yet begrudge the fee for the oculist who can tell them what is worth a thousand teeth.

I recollect as if it were yesterday, how, years ago, a physician complained to me of his difficulties in getting a living by medicine, and how, in order to increase his income, he examined pathological specimens and made urinalyses. He said: "I ask a small fee, but I cannot get physicians to give me the slightest help. They say they can get it done for less. But you know that the man who asks these minimum fees is not an educated man, and that his quantitative analyses are guess work."

This was twenty years ago, but the same bargaining spirit, the same jealousy, the same belittlement of special medical work by some of the profession, the same dread of losing a patient by sending him to a consultation, all exist to this day. And, to cap the climax, that same complaining physician at last slowly prosperous, now consults an optician and sends to prolonged medical struggles another medical man, the oculist, as he himself was sent by those of his own time.

Another important cause of the rise of the optician to the title even of "Doctor," is the belittlement of the medical profession as a whole by many people of today.

Granted that surgeons are on the top today, owing to the prestige of surgery, and that as surgeons they have nothing to fear in popular estimation, I urge that medical practitioners have less influence, in inducing their patients to consult the oculist than of old, and that the oculists also live under this blighting influence. Many people use ancient prescriptions, many rely on patent medicines, others on counter-prescribing, and many have abandoned medicine altogether for various forms of nonsense. Together with this tendency, many men have rushed into the practice of medicine who would, on their own confession, be better clerks and market gardeners. People act more irritably toward their medical friends than of old. Sooner do they forget their wonderful successes.

So far as the oculists are concerned, people, and physicians, too, complain of the large examining fee. They cannot see why anybody should get so much money for so little work. They forget that what the fee represents is great, for upon a conscientious examination of the eyes depends not only the enjoyment of sight, but of health.

To this belittlement of the profession, as a whole, has been added that dreadful jealousy of other men. Physicians hate to have it said that they ought to have sent that headache patient to an oculist, months ago, for a proper eye test. In order to avoid this, some of them pander to the opticians. The physician and the optician both failing, say that they have "*done their best*," when an educated oculist would, in all human probability, have solved the problem. Some physicians refuse to believe that headaches can come from eye strain. Some oculists still laugh at the muscle fad, in which there surely are some good grains of solid truth.

Just as people belittle physicians, and are jealous of the money that they are supposed to make, so some physicians belittle the testing of the sight, let patients go to optical shops, and even go there themselves.

Physicians, again, have a way of diminishing the practice of their fellow doctors, the oculists, by sending minor operations, like chalazion, squint, and foreign-body removals to hospitals, instead of oculists' offices.

The practice of medicine is full of curious contradictions. A physician puts some urine into a machine and sets it revolving. In a minute it is done. With reagents in another minute something more is done. Waiting a while for a sediment to form, the microscope is employed. Now *that* is something great, because

from those tests the physician has made a diagnosis of the condition of the kidneys. So, too, are a few taps on the thorax to diagnosticate a pleural effusion, or the brief listening to the heart to detect a murmur! Apparently, these acts are trifles. If you say so, you are reproved for belittlement of the physician and his art.

If, however, an oculist takes more than a few minutes to test the sight and to use the ophthalmoscope, and, generally, to make a careful diagnosis of the eyes, it is *nothing*. "*Any child can test the eyesight.*" Those who say this forget that it is the putting of all the tests together which makes an examination worth having. Under the belittlement idea, it is a mere nothing, calling for no more than what is advertised as "Eyesight Tested Free." "Why don't you ask your optician if there is anything the matter with your eyes," just as if he knew, anyway. How can he know, knowing nothing, except what the patient tells him that he can see right straight ahead.

Some physicians recommend people to opticians because the optician and his family are patients. Here, it is difficult to avoid offense, but the optician need not know that the physician has sent a patient to an oculist, unless he chooses to open his mouth. Expectant favors, are, however, repaid at a dear price, for the less a physician has to do with exchanging bills with his patients, the better off is his purse.

I have heard of patients being sent by medical men to opticians simply because their favorite oculist was out of town. Rather than let their friend later on discover that a second oculist has been recommended, they soothe their conscience by suggesting an optician.

Many a time the opticians have gone before State Legislatures with the signatures of medical men appended to petitions to enable them to receive official endorsement that they can test eyes as well as educated oculists. But what a slur on their own practice. For, if uneducated men can prescribe lenses for diseased eyes, as well as educated oculists, why on earth cannot uneducated quacks prescribe for diseases of every part of the human body just as well as can educated physicians? However, it is only the strong-minded man who can say "No" and stick to it. Where one says "No," a thousand sign, pass on, and forget what they have done, or the meaning of their deed.

Many people consult opticians simply for the purpose of looking over their stock in trade; they want to pick out a frame, lens.

grip, or chain to suit themselves. The opticians permit the wearing of eyeglasses where spectacles are the only thing advisable. It is a good deal like the bargain days. Possibly, *free* testing comes into play, the visitor forgetting that he has to pay in other ways.

Just as physicians should not hire a correspondence-school nurse, so should they not advise patients to consult opticians. Just so little as a physician would like to see his own son educated for four years of college, and four of medicine, and a year of special study on the eye, then driven to the wall by competition with uneducated opticians, so little should he drive the sons of other men in similar competition.

Having spoken at too great length, perhaps, of existing conditions, let me offer some remedies.

Eye sight testing is a medical act, and should be done only by medical men. This is difficult to prove, even to physicians, some of whom, as we know, will not believe it. But we must insist upon it all the more, and preach it at every opportunity. A chemist can analyze the urine, but he cannot apply what he has learned to the cure of a disease of which he knows nothing. An optician can tell that the sight is not normal, but he cannot possibly tell whether that subnormal sight is due to diseased refractive conditions of the eyes or to inflammatory diseases of a deeper-seated nature. In giving the best lenses that he can find, he has only half completed his duty and has left the patient in a condition which may lead to permanent disturbances of sight. If people wish to trifle with their sight, we cannot prevent them. But we must teach everywhere, that if the heart is failing in its duty, it is to the physician to give advice; if the lungs are diseased, consult the physician. If the eye sight is not perfect, consult the physician who understands what the defect it. 'Make it plain, that any eye which cannot see the standard letters at the standard distance, is a diseased eye, and needs the examination of a physician-oculist.

It is a modern tendency to try to get rid of middle men, and as such, oculists in cities of moderate size are regarded, in so far as they test eyes, and then foolishly send the patient with a prescription to an optician.

To furnish our own lenses would seem to be a powerful antidote to the optician disease.

If people could know that they could get examination, lenses, and all, at an oculist's, they would recognize him less as a middle man. For what attracts people more, even to the opticians, than

the free eye-test, is the chance to pick from a good stock in trade, something looking nice and fitting well on the nose. Many a case have we lost, with which we could have bargained had we something to show. Do you blame me for this suggestion? Do not forget that even the doctors give remedies in more pleasant forms than of old. Let me suggest, then, to the younger men, to lay in a stock. Let me urge you to visit an optician and learn the tricks of his trade, such as the making of repairs, the bending of springs and frames, the adjustment (so-called) of lenses. Opticians have invaded our field, why may we not protect ourselves? I have not for years sent a patient with a prescription to any optician. Every pair of lenses has come from the grinder to me; I deliver them to the patient. For repairs, the lenses come to me and after the optician has done his work the lenses go back to the owner, from me. In this way I have held on to some patients for as many as twenty years.

We could in this same way hold on to our medical friends, personally, by having a choice stock of goods from which they could pick. Holding them personally, they would think of us oftener whenever they had occasion to suggest an examination of the eye. Do not call this suggestion meretricious. It is merely an appeal to the human side of things, as in every trade or profession.

A remedy for the differences between all physicians is organization. If organized, physicians could do great things. There would be less jealousy. Why is it that we can admire an operator who does beautiful work in some other place, yet talk half-heartedly about him if he lives in our own town? If organized, all physicians would *tend* to support one another. Lawyers are human and have the same feelings, as men, as we have. Yet being organized, they maintain a high standard of integrity toward one another. As they have made the law to belong to lawyers, we should band together to make, as far as possible, medicine belong to medical men. If, as an organization, we frowned on patent medicines, our influence would be felt. If, as an organization, we frowned on improper fitting of lenses by uneducated men, that, too, would have weight with the public. The mere assertion in the papers that an organization of physicians was opposing certain measures would call the attention of people to such measures, concerning which they may never have thought. If medical men made an organized opposition to ignorance of every sort, they would gain a victory now and then, despite the strength of superstition.

Many physicians are afraid to join a society. They think that the other man will get ahead of them, in some unknown way. They fear a trap. What is the result? Quackery triumphant. Of this there is no more brazen exhibit than on the part of opticians who sell smoked lenses worth a few cents for \$7, or gold-filled spectacles worth \$1 for \$5, or *radium* lenses (plain smoke glass) worth a song, for such price as \$55. I mention also glaucomatous eyes going blind while waiting, as the opticians tell the poor sufferers, "for the cataract to get *ripe*."

English medicine has lately shown what organization will do. A vaccinator, believing that his grant was inadequate, asked for an increase. This was refused and his resignation demanded. It was given, and the vaccinator informed the members of his medical branch of his reasons for resigning. When the authorities advertised for a new vaccinator at the old rates, no one applied, and they were obliged to reinstate the former holder at the terms asked for.

Organize! Join with other medical men. Outside you are narrow, selfish, jealous. Do not forget that every medical man has just as much right to live as you have, and that the more you help him, when you possibly can, the more you honor yourself. There is not a single physician anywhere from whom you cannot learn something useful. The greatest minds of all ages acknowledge with cheerfulness and humility that even from the humblest of men they have learned something to their benefit.

Even the opticians have organized to fight for what they are pleased to call their rights. They forget it is true that they are taking away ours, given by our license to practice medicine. If they wish to be licensed, let them be examined by medical men. Any man can plane a bit of wood. It is the educated man in that line who can plane it best. What we ask of physicians is that just as we know that every patient of theirs will get the best medical advice that education can give, so we look to every patient of ours getting the best that study of the eye can give. Let physicians send to the oculist every case of eye disease that they see, and amongst these first, last, and always: I recognize an eye with defective sight.

Every State should have its association of oculists which should send to all physicians a fee table, to be shown, on occasion, to patients whose means are moderate. This table could show a reasonable fee for the examination, the glasses to be sold at cost. If people knew that lenses for which their friends had paid the optician \$5 were worth but \$2, they would see that for the

*free test* they had paid \$3. If they saw that for a fee of from \$3 to \$5 to a doctor, the lenses to be from \$1 to \$3 more for the very best, they would prefer to pay the best man. It is our \$5 fee which keeps the opticians alive. For people think that besides this fee to the doctor, there is another \$5 to the optician, and \$10 is a good deal of money for people in moderate circumstances. So, many fall into the trap. The proposed fee table could go farther, and authorize physicians at a distance from city oculists to guarantee a fixed price for examination and lenses included, asking, for instance, a minimum of \$5 and a maximum of \$10.

This seems a possible means of reaching the great middle class, who hate dispensaries and hospitals, and free treatment, but who, with their moderate incomes, are unable to pay large fees to the oculist and then the same old price to the opticians.

What would the opticians do if this plan were carried out? I reply that they would find plenty to do in grinding lenses, in making repairs, and in fitting simply presbyopic eyes with lenses, as patients grew older. For it would never do to compel people legally to consult, for a fee, an oculist, every time that they wished for a slight change as they grew older. Such limitations we must make, although urging necessary visits for the eyes at any time as much as for the teeth.

Hold to high ideals, and make the people rise to those. The great difficulty lies in finding the way in which to spread before them the suggestions contained in this paper, as well as in many others read before meetings like ours, and then printed where people never see them. *Associations* of medical men of all sorts should choose a publication committee who should make arrangements to print in the papers of today appropriate medical articles as the opinions of a respectable and educated body of men. This would go farther toward public education than to send reprints amongst medical men alone. Advertising thus themselves as a body of medical men, the names of the writers need not appear, any more than there is a signature to newspaper editorials. Personally, I advocate in this war against the uneducated fitters of lenses the public advertisement in prominent newspapers of the EXISTENCE of an association of oculists; of medical men who devote their attention to the eye, who urge that people with weak or defective sight should consult medical men as best and cheapest in the end.

I am in favor of every association of oculists issuing its own test type card, with its name and purposes set forth, front

or back. This card is to be handed to every physician in the State to use in his office, and to have in sight as a regular reminder of the existence of this association and its members. It might be advantageous to print on the backs of those cards to be sent to physicians the fee-table-suggestions mentioned before.

Association members should be sent to schools and colleges to test the sight and eyes in every way, and to follow such testings for the four years of school and college life. Keep in touch with the public, with published accounts of what you are doing in this line of actual education.

During my thirty years of practice, I have met many school teachers, and I have always found them open to argument regarding the need of most careful testing of the eye sight. Many have in times past asked me to send them a test card, so that they could *seat* their pupils according to their sight in the schools. Thinking over, then, in the composition of this paper, the encouragement offered by teachers past and present in Maine, I would have association test type or test cards sent to teachers throughout the State, to be hanged in the schools.

Fellow members, this topic is as broad as the ocean, and I am simply contributing my little drops of thought to its solution. Let me offer now a *resume*.

Many medical men help opticians when they ought to help their fellow practitioners in eye-medicine. The reasons are thoughtlessness, ignorance of the need of deep study of the eye to fit lenses properly, complaints of the cost, fear of losing families to half specialists and half medical men, belittlement and jealousy. Remedies suggested are recognition by physicians that the eye is an integral part of the body and should be tested medically; that an eye which does not see perfectly is a diseased eye and needs medical testing. These doctrines physicians should teach and uphold. Oculists should be well educated, ethical, honest men, free from jealousy and well equipped to enter into the changed aspects of modern life by which opticians have obtained, through advertising, an extensive hold on a portion of the domain of medicine to which they have not the slightest right, because of their total lack of medical education. To meet these conditions we must prove to people that we know more than they do, we must carry goods as they do, we must hold on to our own prescriptions and repairs. We must learn their trade so far as that is compatible with medicine.

Speak as fairly of your competitors as you can, and they



will be likely to treat you in the same way. No one can be perfect, so why find fault with what others have done by mistake—perhaps they were rushed with work, perhaps they were tired. Everybody makes mistakes and will continue to make them. If your fellow practitioners joke you about your big fee, just pass along to them how many small fees they make to your single one. If they drop the hint that you ought to change lenses for nothing, just give them the little reminder that their patients pay for the second, or even the third bottle, made from the original prescription.

Organization is imperative, for when we pay to defend our rights, as we do pay in keeping up an association, we touch our pockets, the source of our means of living. Once organized, we can fight better, and so enjoy our share of public patronage. Don't run down the opticians. Don't make martyrs of them. Simply assert our claims. Say nothing against theirs. A certain class of people will always consult opticians because their incomes are small; many will consult them rather than have anything to do with a doctor. It is quite certain, however, that by following some of the suggestions made by numerous writers on this vexatious topic we shall obtain many new patients which we have lost hitherto by keeping what we know about the eye, and its functions, and its relations to the body, altogether too much to ourselves.

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## ADVANCEMENT OF THE CAPSULE OF TENON IN MARKED CASES OF DIVERGENT SQUINT.\*

BY WILLIAM F. MITTENDORF, M. D.,

NEW YORK.

The causes of divergent squint are so well known to all of you that it is hardly necessary to mention them all, and in many cases a mild divergence can hardly be named a deformity. It gives the person thus afflicted some times an interesting appearance, and in some families a slight divergence is some times met with where there is perfectly normal vision of both eye, and where this seems to be an inherited condition.

When we have the cases of divergence due to paralysis of the internal recti, and even after most of the other symptoms of the

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\*Read by title.

paralysis have disappeared, the divergence may remain as the most annoying symptom. But the most distressing of all cases are those where a convergence *preceded* the divergence, and especially where it follows an operation for convergent squint. However, thanks to more conservative measures employed now in the treatment of convergent squint, operations for its correction are not so frequent as formerly, and as a result failures of squint operations resulting not infrequently in divergence of the eyeball are not so often met with as formerly, and consequently these cases of divergent squint are much less frequently met with than twenty or thirty years ago. Yet even now one will see, some times, cases of marked divergence as a result of operations which appeared to be perfectly satisfactory at the time of the operation, and even for many years later, which eventually turn into very marked divergent squint. This may happen even to the best operators, but of course not nearly so often as after operations performed by less experienced surgeons or physicians. Of course such a result is not only mortifying to all parties concerned, but has also brought the operation for convergent squint into discredit by physicians and patients.

As I mentioned before, the early and systematic use of glasses will cure a very large percentage of all cases of strabismus convergens, and then the advancement of the weak muscle will rarely fail to relieve the convergence, and this operation is hardly ever followed by an over-correction and disturbance of the muscular equilibrium. It must likewise be admitted that the tenotomies are now done much more carefully than formerly, and are, as a rule, more successful than they were formerly.

Yet when we meet one of these distressing cases, which, as a rule, are a great deformity, and occur more frequently in adults than in children, we are usually met with the remark that they have had so many operations upon their eyes that they refuse to submit to another, unless we can give them the full assurance that it will be successful. This I had not been able to do until I resorted to the most radical way of treating these cases, and I have been so universally successful that I do not hesitate to promise the patients a complete relief of their deformity.

My plan of treatment has been to make a very free tenotomy of one or both external recti muscles, and in some cases make even a shortening of this muscle by removing a small piece of it, as the first step in the operation, and I have never applied a suture, thinking that the dressing of the eye after the operation will keep

the parts in place and prevent all swelling. The next step is to expose the internal rectus. This is usually inserted away back beyond its original point of insertion, or it may be found to be a thin, flabby muscle. After freeing the muscle from all old adhesions, which are sometimes very firm when the divergence came as a result of a tenotomy for convergent squint, I bring it well forward, after separating it from its attachment to the eyeball, take as much of it as I want to remove in my forceps, apply my sutures behind the forceps, usually three in number, and remove this part of the muscle, together with a more or less liberal piece of the capsule of tenon, with the overlying conjunctiva, and advance the remaining parts, which includes the shortened muscle, the capsule of tenon and the conjunctiva, and fasten it to the anterior part of the eyeball as near to the sclero-corneal margin and in as secure a manner as possible.

After cleaning the conjunctival sac carefully, I apply a firm bandage with a small piece of linen smeared with boric acid ointment placed over the closed lids, and over this a moist, soft surgeon's sponge; over this a moderately thick layer of absorbent cotton, and over this the bandage. As a rule I do not remove the bandage in forty-eight hours. This firm yet elastic pressure, prevents all swelling of the parts and aids the sutures in keeping the parts perfectly quiet until firm union has taken place. The bandage must be renewed several times during the following four or six days, when, as a rule, the union of the parts is so firm that dark glasses may now be used until the eye is ready for the correcting glasses. The sutures may be removed much later, unless they cause much irritation and annoyance. Granulations will sometimes start in the wound, but this is not so frequent an occurrence in the wound over the external recti, even if no stitches had been used here.

The following cases have been taken at random from my case book, and in all of them many months have passed, and still the results are as good as can be desired:

Case I. Miss H., age 19, Northampton, Mass. Strabismus divergens, 0.5.

The left eye has been a poorer eye, as long as she can remember, at one time was convergent, then it became straight, and for two or three years there was hardly anything abnormal to be seen, but for the last five or six years the eye began to turn out, and this has gradually increased to such an extent that the white of the eyeball has become so prominent that it is very embarrassing for

her to go out, or to go to any place of amusement, because the people look at her. She is otherwise a very pretty girl, and enjoys excellent health. The fundus of the eye is healthy.

An advancement of the capsule of tenon, including the shortened rectus internus and conjunctiva, was made and the external rectus freely tenotomized at the same time. The stitches were removed only a few weeks after the operation, and the result was at once very satisfactory. Correcting glasses were worn for more than a year, but she gradually used them less and less, and now she has discarded them entirely. She got married since, and there is no trace of the former opacity nor any sign of the operation present.

Case II. Mr. G. H., 28 years of age, of Washington, D. C., a druggist by profession.

When a lad ten years of age the right eye was operated upon for convergent squint at Washington, and glasses were prescribed, which he has used ever since with slight changes at times. Some five or six years ago the right eye began to diverge, and he had last year two operations performed, one at Washington and later one in Brooklyn, where he is now employed as a drug clerk. He was sent to me by one of his friends, but when I told him that the eye had to be operated upon in order to remove the defect, he became impatient, saying that three operations were enough for him. I gave him other glasses and advised him to think it over. He returned very soon, saying that everybody asked annoying questions about his eye, and if I could give him the assurance of a favorable success he would be willing to submit to an operation. As the case was really a very marked one, and as the former operations had not been successful, I decided to tenotomize both external recti freely, and to advance the capsule of tenon, conjunctiva and muscle, and after removing a fairly large elliptical piece of the capsule of tenon with conjunctiva, shorten the tenotomized internal rectus muscle by removing a piece of it near the divided tendon, and advance these parts as near to the cornea as possible.

The healing of the eye was quick and uneventful, and after two or three weeks he was able to resume his work with the eye in perfect position and very little thickening of the advanced portion. This thickening, as well as the redness, had entirely disappeared, and the action of the internal rectus of the right eye was now as perfect as possible. His headaches, which had been very annoying at times, had entirely disappeared, but he has never been able to discard his correcting glasses.

Case III. Mary Sch., 26 years of age, of New York City.

Patient is a very attractive girl, with very large eyes, and on account of the prominence of her eyes the divergence of the left eye is very marked and is quite a deformity. The eye began to diverge many years ago, but she did not have the courage to have it attended to, but now she finds it hinders her very much in her business, and besides her eyes tire easily and she has a good deal of headache. Both eyes are slightly myopic. She accepts — 1.25 for the right, and — 1.75 for the left eye, and gets normal vision with these glasses in each eye. However she has only monocular vision, and all efforts at convergence are of no avail to bring the left eye beyond the median line. The external rectus is quite weak but not enough to allow any divergence. The operation in this case consisted in a free tenotomy of both external recti, and the advancement of the capsule of tenon, after the removal of a small piece of the dissected internal rectus, and a fairly large elliptical piece of the capsule and the overlying conjunctiva. The result was very satisfactory, but there remained a small granulation mass at the nasal side of the eyeball, but this became eventually paler and smaller, and a few months after the operation had entirely disappeared. The position of the eye remained very good, and there is now binocular vision and the diplopia which existed for some months has now entirely disappeared. She is using her correcting lenses all the time, but I do not think that this makes much difference, and the eye is perfectly straight, even without glasses.

Case IV. Mrs. J. P., 33 years of age, of Bayonne, N. J. When a child six years of age she was operated upon by Dr. Agnew, who made a tenotomy of the left internal rectus for convergent squint. The result was quite satisfactory for several years, and glasses which were given to her for reading and near work were gradually abandoned. During the last years of her school life the left eye would occasionally diverge. Later this defect became more marked and permanent. Some five or six years ago she placed herself under the charge of Dr. Stevens, of New York City, who, according to her testimony, performed six or eight operations, first on one eye and then on both, trying advancement of the internal rectus after tenotomizing the external recti. When the lady presented herself at my office, upon the recommendation of Dr. Coleman, of this city, she complained about the deformity of her eyes, inability to use them for any fine work, and severe and almost constant headache. There was very marked divergence of both eyes and complete loss of the use of both internal recti and the conjunctiva, showing many scars and much redness of places where

the operations had taken place. The lady could not look straight at an object, but had to turn her head correspondingly. Both eyes had nearly normal vision with the correcting glasses, but no diplopia, as she could not converge at all; in fact, she could not move either eye beyond the median line towards the nose, whether she used the eyes singly or made a combined effort. Up and downward movements were only slightly affected. In this case a most radical procedure was necessary, and I made a very free tenotomy of both external recti and removed some of the muscle itself. I then proceeded to find the remnant of the internal recti, and I was fortunate to find both of them inserted almost at the posterior half of the eyeball. The anterior part of the capsule of tenon and the inner portion of the bulbar conjunctiva was stretched considerably and very thin. After securing the muscle I removed an elliptical piece of the capsule of tenon, as well as of the conjunctiva and a small piece of the muscle itself, and advanced the remaining part as far as possible toward the cornea, including the muscle in the suture, and fastened the parts by means of three double stitches. No suture was applied to the temporal wounds where the external recti had been cut. After washing the parts very thoroughly with a mild bichloride of mercury solution, I applied a drop of atropine to each eye, because I feared that the cornea might have been slightly injured during the operation, and applied a sponge-pressure bandage over the eyes. My reason for a sponge dressing to the eye was to prevent undue swelling of the conjunctiva and eyelids, and at the same time not to interfere with the nutrition of the parts, for I had left only a narrow portion of the upper and also of the lower part of the eyeball undisturbed. After removing the bandage for the first time, nearly forty-eight hours after the operation, I found both eyeballs in good position. I applied now an ordinary pressure bandage, which I kept on for five days longer, renewing it every day. I now replaced the bandage by a pair of dark coquilles. There had been no suppuration of the wound, and the stitches had remained in perfect position. There was a slight convergence of the left eye and a slight diplopia, and some thickening at the nasal side of each eye, but the wounds healed nicely and this thickening, which I just mentioned, became gradually less and less, and four weeks later there was only a slight redness remaining. The result of the operation was most satisfactory, and with a strong convex lens the slight convergence of the left eye became better and in a few weeks the movement of both eyes had become so perfect that it was almost incredible that the slender

internal recti which I found at the time of the operation could now act in such a perfect manner. It is now eight months after the operation, and the lady is able to use her eyes for reading and sewing perfectly and without fatigue. She has no more headaches, and as long as she has the glasses on the position of the eyes is perfect, and only after removing the correcting lenses is there a very slight convergence, and even this seems to be improving constantly, and becomes less and less apparent.

This was one of the most aggravated cases I have ever seen. If one eye only is affected, the advancement of the divergent eye alone is sufficient, and only if the squint is very marked does it become necessary to tenotomize both external recti at the time of the operation. Usually the external rectus of the squinting eye alone has to be cut, but I believe in a very free division of this muscle and its attachments in order to give the advanced muscle an opportunity to form a firm union with the advanced capsule of tenon and the overlying conjunctiva. If such a union takes place and enough of the capsule of tenon and also of the muscle has been removed, it is not only impossible for the eye to diverge again, but the action of the advanced muscle becomes perfect, and there is hardly any defect in the movement of the eye to be seen.

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## INTERSTITIAL KERATITIS EXCITED BY TRAUMATISM.

BY THOMAS FAITH, M. D.,

CHICAGO, ILL.

In a perusal of the latest ophthalmic text-books, and the current literature on interstitial keratitis, it is rather a noticeable fact that while various etiological factors are discussed at length, either no mention at all, or only a passing mention, is made of the exciting factors which precipitate the attack, in the so-called typical forms of the disease. The reasons for this I am led to believe are the failure on the part of clinicians to record personal observations, and the fact that up to the present time experiments have failed to produce the typical form of the disease.

Most authors have accepted the opinions of Leber, and his followers, who regard the disease as invariably secondary to uveitis, and various experiments have been carried on by Samelsolin,<sup>2</sup>

Rachlmann,<sup>3</sup> Leber,<sup>1</sup> Wagenmann<sup>4</sup> and Siegrist, Mellinger,<sup>5</sup> Berri,<sup>6</sup> Hippel,<sup>7</sup> and others, with the view of determining the particular pathogenesis of the disease; but of these experiments Parsons<sup>8</sup> says none of them can be regarded as affording typical examples of the clinical form of interstitial keratitis, the immediate cause of which is yet to be sought. Nuel<sup>9</sup> voices practically the same opinion as Parsons, though Holmes Spicer<sup>10</sup> thinks that the same series of experiments show that the disease begins primarily in the ciliary blood vessels.

The disease is, of course, but an expression of a cachectic state or dyscrasia of the general system, and the conditions which are known to be responsible for its existence are congenital syphilis (first recognized by Hutchinson), acquired syphilis (Hippel), tuberculosis (Michel), scrofulosis (Mackenzie, Fuchs), rheumatism (Leber, Parinaud, Brunner, Fournier, Knies and others), malaria (Arlt, Albrant, Berber, Bock, Knies, Mandelstamm, and Raynaud), influenza (Adler, Ehrlich, Greeff, and Pfluger), diabetes (Albrand, Cundemand, Michel), menstrual disorders (Davidson, Koenig, and Noblat), and leprosy (Greeff, Morax, and Trantes); but what occurrences or conditions may precipitate an attack of the disease in a patient, the subject of one of the above disorders, remains to be determined.

As previously stated, Leber and most other authorities, consider the disease to be invariably secondary to uveitis, but why every case of uveitis (and more particularly anterior uveitis) is not accompanied by interstitial keratitis, is yet to be explained.

That local injuries, irritations, or alterations in circulation may cause the localization of general conditions is an established clinical fact, and may be readily ascertained by referring to any standard medical or surgical work; and that trauma plays a particularly important part in this connection may be seen by the following quotations, which might easily be multiplied many times.

In an excellent article on tuberculosis in Gibson's *Practice of Medicine*, Hector Mackenzie<sup>11</sup> says an injury to a joint or lung may be followed by tubercle, and it would seem that as a result of the injury the part was less able to offer resistance to the tubercle bacillus.

In an article on syphilis, in the same work, Mr. Mackenzie<sup>12</sup> says injury to the tibia is connected with the frequency of nodes upon its crest, and the exposed position of the knee and its proneness to injury, especially in working women, explains the frequent localization of a gumma in the skin over it.



Lupus vulgaris may be determined by local injury, according to Sparks and Sangster.<sup>13</sup>

Local and frequently recurring irritations may determine the development of cancer, in persons, at least, who are so predisposed, according to W. Allen Jamieson.<sup>14</sup>

If, then, an injury may cause the localization of general conditions in other parts of the body, why may it not also cause such localization in the eye and particularly in the cornea, a structure which, according to Leber, is entirely nourished by osmosis?

Fuchs,<sup>15</sup> Nuel<sup>16</sup> and others describe a form of parenchymatous keratitis of a circumscribed character (*keratitis parenchymatosa circumscripta*), which not infrequently develops after injuries, especially contusions, and it has also been observed by them in gout, malarial cachexia, influenza and syphilis.

Of this form of keratitis Schirmer<sup>17</sup> says: Disciform keratitis and keratitis post-variolosa are identical, and have nine points in common. These are: First, slight trauma as a cause, and second, central opaque disc in the deepest corneal parenchyma, surrounded by one or more complete or incomplete grey rings, with radial lines into the epithelium over the disk, which is of a stippled appearance. Third, of lowered sensibility. Fourth, clear cornea separates the disk from the limbus. Fifth, superficial ulcer is frequent. Sixth, the uvea is slightly involved. Seventh, the course is long (six weeks or more). Eighth, therapy is of little avail. Ninth, marked permanent leucoma results.

In so far as the pathological changes are concerned, circumscribed parenchymatous keratitis or disciform keratitis and the so-called typical or diffuse interstitial keratitis apparently differ only in degree, as the names would imply; for in both conditions there is deep infiltration, and varying degrees of vascularization.

A. Peters<sup>18</sup> (Rostock) explains the formation of keratitis disciformis by, first, cedema, which appears as a result of injury of the nerve endings in the cornea, the same as commonly occurs in injuries to nerve tissues in other parts of the body. This cedema, in turn, injures the endothelium of the posterior surface, and allows the aqueous to enter the cornea, thus intensifying the opacity.

After a thorough consideration of the above points, it seems that if circumscribed interstitial keratitis may be excited by traumatism, as is admitted by Fuchs,<sup>15</sup> Nuel,<sup>16</sup> Schirmer,<sup>17</sup> de Schweinitz,<sup>19</sup> and others, and if diffuse interstitial keratitis differs (pathologically) only in degree, why may it not also be excited by

trauma? And it is the purpose of this paper to try and establish the fact that a trauma may excite a typical interstitial keratitis, in a patient having a latent dyscrasia which would predispose to such a condition.

This idea has been forced upon my mind by the following cases, which have come under my observation in the past few years:

M. D., a schoolgirl, aged 11 years, came May 2, 1901. She had never had any previous eye trouble. On the previous day, while returning from school, patient stopped to look through a window at some men working in a planing mill, when something was forcibly thrown against the window from within, shattering the glass and injuring her right eye.

There was considerable difficulty in obtaining a view of the cornea, and it was necessary to instill a solution of cocaine, in order to make a satisfactory examination, which revealed a large corneal abrasion at the upper margin, and a piece of hardened putty, 2 by 3 mm., was removed from the upper cul de sac. Atropine, cold applications, boric solution, and a bandage were ordered, and a good prognosis was given.

May 4th, the abrasion was smaller, but was surrounded by a small area of infiltration, and thinking I had to deal with a slight infection, I ordered a solution of atropine for home use, and changed from cold to hot applications.

May 7th, abrasion practically healed, but the area of infiltration in the cornea was larger, with no apparent tendency to ulceration—a fact which was rather puzzling. The flushes, atropine and hot applications were continued.

May 9th, the infiltration was extending rapidly inward toward the center of the cornea, and was distinctly deep in character; the corneal wound was entirely healed.

May 11th, the deep infiltration covered more than half the cornea, extending downward in a rather irregular triangle. A tentative diagnosis of interstitial keratitis was made, as the child presented undoubted evidence of inherited syphilis. There were scars at the angles of the mouth, cupping of the central incisors above, and partial deafness. She was also undersized, and had a loose, leathery appearance to the skin.

On May 16th, the cornea presented the typical ground-glass appearance of interstitial keratitis, with stippling of the epithelium, and the iris could scarcely be seen. From this time the case ran the usual course, and about six weeks later the left eye became involved.

The patient was kept upon inunctions, atropine and hot applications as long as the active inflammation lasted, and when all circumcorneal injection had subsided was put upon yellow oxide salve locally, and mixed treatment internally. She was discharged in March, 1902, with R. V.  $\frac{20}{80}$ ; L. V.  $\frac{20}{60}$ . Opacities and blood vessels could be seen in both corneæ with the ophthalmoscope.

Case 2. H. M., male, aged 22, a porter, came April 26, 1903. Has never previously had any disease or injury to the eyes. On the previous day was struck in the left eye with a rattan carpet beater, while he and a friend were at work cleaning a rug. Patient complained of severe pain and photophobia. Inspection revealed a rather deep cut in the upper outer quadrant of the cornea, but not penetrating the anterior chamber. There was considerable denuded epithelium, which stained readily with fluorescein. Atropine, boric solution and a bandage were applied, and when the case was seen, four days later, there was a distinct area of infiltration surrounding the abrasion, though the wound seemed to be healing. At the end of a week the cornea was well infiltrated in the upper outer quadrant, and the infiltration was of a deep character. By May 12th the case was a well developed interstitial keratitis, involving all of the cornea but a small area in the lower nasal portion. I never saw the case after the above date, which was eighteen days after the injury, but am satisfied that it was an interstitial inflammation, if for no other reason, from the fact that there was a well-marked deep vascularity of the cornea.

This patient was, so far as I could determine, in perfect health; he knew very little of his family history, and had never suffered from any serious illness.

Case 3. D. T., male, carpenter, aged 23. Patient came first on October 20, 1903. He was suffering with a severe attack of interstitial keratitis in the left eye, of three weeks' duration, and there was a large salmon patch in the upper temporal quadrant. Vision shadows. Patient was a small man; had never been strong; had distinct evidence of hereditary lues, viz., Hutchinson's teeth, cervical adenitis, complete alopecia, and marked serous effusions in both knee joints.

Atropine, hot applications and inunctions were ordered and continued until January 5th following, when, the active inflammation having subsided, the treatment was changed to yellow oxide ointment locally, and mixed treatment internally. Vision =  $\frac{13}{200}$ . Patient returned to his work.

April 4th. He returned, on account of an injury to his right eye, which occurred three days previously. While driving a nail, the head had broken off and struck him in the eye.

Examination revealed a large ulcer near the center of the cornea, the ulcer bed was covered with necrotic tissue, and was surrounded by a distinct area of infiltration.

The ulcer was cauterized with 95 per cent phenol, atropine instilled, and a pressure bandage applied. Ten days later the ulcer had healed, but the infiltration had extended to a considerable extent, and with the loupe blood vessels could be seen entering this area of infiltration from the corneal margin. Later the disease process gradually extended and became more intense, until the iris was entirely hidden from view.

The case was watched for about ten weeks, the clearing process having begun when the patient was lost sight of. Mercurial inunctions, atropine and hot fomentations was the treatment adopted throughout the second as well as the first attack.

Case 4. Furnished through the kindness of Dr. J. B. Loring, of Chicago. Miss O. M., aged 32, was first seen January 5, 1901, on account of a burn of the left cornea, sustained four hours previously with a curling iron. The conjunctiva was injected, and there was much pain. V.  $\frac{6}{9}$ . Atropin, sterile vaseline, and a bandage, were applied. January 8th, a slight ciliary blush was present, and there was a slight cloud in the cornea around the injured spot. On the 16th, there was considerable infiltration of the cornea, most marked at the sight of the burn, with marked ciliary injection. In another two weeks the greater portion of the cornea was infiltrated, and vessels could be seen extending deep into its substance; the epithelium was intact. In April there was still a slight cloudiness of the cornea. Vision was  $\frac{6}{12}$ . In February, 1905, the patient was found to have  $\frac{6}{8}$  vision, with correcting lens, and small nebule and the remains of blood vessels could be seen in the cornea. The patient was a subject of inherited lues.

In addition to the above cases, I have collected the following similar cases from the literature, some of which I am unable to supply in detail on account of the inaccessibility of the literature. They include, however, all that have so far been published.

Brenski<sup>20</sup> reports a case of parenchymatous keratitis following injury, in an inaugural dissertation at Giessen, in 1881.

Anke<sup>21</sup> reported a case of keratitis parenchymatose from Hirschberg's clinic, which followed the splashing of acid into the eye.

Brunner<sup>22</sup> contributes two cases of parenchymatous keratitis,

which followed trauma of the eye in luetic individuals, viz.: (1) A fourteen-year-old girl, with characteristic history and symptoms of hereditary lues, and who up to this time had never had eye disease, was seized with the specific form of corneal disease, five days after being struck on the eye by the handle of a small mill, and in whom five months later the same affection appeared in the other eye. A cure was effected by mercurial inunctions and potassium iodide. (2) Was the case of a man, 21 years of age, with typical hereditary syphilitic physiognomy, who had never suffered of eye disease until four days after an injury to his left eye by a fragment of coal. Thereupon a parenchymatous keratitis followed, which soon advanced to the second eye. The case was only relieved after eight months of inunction treatment, and with preservation of only one-half vision.

Szapoda<sup>23</sup> contributes the case of a girl of six years of age, a subject of hereditary syphilis, and who had heretofore had no eye trouble, in whom a parenchymatous keratitis followed a wound of the left cornea. The right eye was later attacked by the disease.

Valude<sup>24</sup> reports a case of syphilis hereditaria with parenchymatous keratitis following traumatism.

Breuer<sup>25</sup> noted a case of parenchymatous keratitis, in the Giessen University Eye Clinic, which followed immediately after a trauma.

Armaignac<sup>26</sup> reports a case of this character in a mechanic of thirty-four years of age.

Noyes<sup>27</sup> reports a case of parenchymatous keratitis in an infant, the condition following an injury caused by forceps delivery. There was no evidence of hereditary syphilis in this case, and the condition was limited to one eye.

Morinani<sup>28</sup> reports the case of a girl, twenty-one years of age, who had never previously suffered from eye or other disease, in whom the left eye showed a typical parenchymatous keratitis following an injury by a plum which struck the eye and caused inflammatory reaction, and on the ground of the healing obtained by tuberculin the tubercular nature of the disease was inferred.

Bietti<sup>29</sup> reports two cases from the Freiburg University Eye Clinic. The first, a farmer, forty years of age, suffered an injury to his left eye through a small pebble, and eight days later developed an atypical parenchymatous keratitis.

The second, a peasant girl of twenty years, developed a typical parenchymatous keratitis directly after a trauma of the left cornea from a splinter of wood.

Work Dodd<sup>30</sup> reports three cases, all showing undoubted evi-

dence of congenital syphilis. The one suffered a superficial injury to the right cornea by a piece of metal, and directly following developed a characteristic parenchymatous keratitis, the left eye becoming involved later.

The second was the result of a superficial injury to the cornea caused by a mosquito bite, which later developed a typical interstitial keratitis. The second eye became involved, and the case ran the typical course.

The third case began after a blow on the eye by a football. Here there was no apparent corneal wound, but the injured eye developed interstitial keratitis and subsequently the other eye did likewise.

Hummelschein<sup>31</sup> reports the case of a boy, ten years old, in whom a parenchymatous keratitis followed directly upon a blow to the right eye, and attacked the left eye three months later.

Perlia<sup>32</sup> (Krefelt) reports the case of a wire worker of sixteen years who was struck in the right cornea by a fragment of brass, which was removed by one of his co-workers. The eye did not become quiet, but developed a typical parenchymatous keratitis. The patient was poorly nourished, but there was some difference of opinion among the consultants as to whether the general condition was one of inherited lues or tuberculosis. The patient subsequently developed the disease in the other eye.

Limbourg<sup>33</sup> reports one case in a luetic subject, in which a typical interstitial keratitis followed an injury to the eye.

Pflang<sup>34</sup> reports the case of a girl of twenty who suffered from serous iritis in both eyes. A paracentesis of the cornea was done on the left eye on account of increased tension, and was directly followed by a parenchymatous keratitis, which was typical. The patient was a scrofulous subject.

In my own cases, and in all of the cases which I have listed, the type of the keratitis was diffuse, with one exception (one of the cases reported by Bietti), and I am convinced that at least one of the exciting causes of the ordinary form (*i. e.*, diffuse interstitial keratitis) is trauma, and that there are other exciting causes, I have no doubt.

It has occurred to me while studying this subject that possibly the reason for the irregularity in the interval between the attacks in the two eyes is due to the absence of an exciting cause in the unaffected eye, when the other one is attacked.

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## BACTERIOLOGY OF A CASE OF DENDRITIC KERATITIS.

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AND

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On September 14th, 1904, Joseph B., age 19, presented himself with a sore right eye.

Examination showed the cornea involved with a dendritic keratitis, as depicted in Fig. 1.

The usual symptoms of iritis with neuralgic pains and ocular inflammation in general were present. There was no purulent discharge. The patient's family history is bad. We were told that gonorrhea was common in the family. There is no history of malaria.

The patient's physical condition was poor, from probably lack of good food under bad hygienic surroundings. He was put into the St. Elizabeth Hospital under strict treatment.

Upon his admission cultures were made from the ulcer and the conjunctival sac. Only Loeffler's blood serum was available and it was used. Fig. 2 shows the character of the growth made three days after the inoculation of the test tubes. The growths from the cornea and conjunctival sac are alike. The colonies are somewhat depressed.

On September 20th the colonies on the culture medium are still more depressed than when the drawings were made.

On September 22nd the colonies have become confluent and are markedly depressed.

On September 23rd the corneæ of a rabbit were inoculated subconjunctivally with the growth. There was no reaction. The inoculation was repeated the 25th and the 27th, and negative results were obtained.

Slides made from these cultures and stained with the standard aniline dyes, showed what appeared to be a diplococcus, apparently the diplococcus of Neisser. But we had no gonorrheal discharge



from the eye, and, in fact, the eye had never manifested any purulent discharge at all. Hence, a question of doubt immediately arose. Gram's method was used and the bacteria were negative, as is the gonococcus.

Our next effort was to differentiate it from other bacteria, but we could find no known description which answered in all respects the growth which we had obtained.

The cultures were submitted to Professor Severance Burrage of the Department of Biology of Purdue University, but after due searching and staining and cultivating, reported that he could find no bacterium which corresponded with the growth submitted to him. He further sent cultures to Indianapolis and Chicago, but nothing could be learned which would throw light upon the subject in hand.

After consultation with Professor Burrage, a culture was sent Professor Frederick G. Novy, of the University of Michigan. He turned it over to his assistant, Dr. David G. Levy, who, under date of May 19th, of this year, made the following very complete report:

Ann Arbor, Mich, May 19th, 1905.

Dr. George F. Keiper, Lafayette, Ind.

Dear Sir: After an investigation of the properties of the organism received from you, I have been unable to identify it with previously described bacteria. However, it appears to be related to the group of diplo-bacilli associated with affections of the eyes. Briefly, its properties are as follows:

Form: A short thick bacillus with broad ends rounded and often irregularly squared. There is a tendency to arrangement in pairs. The germ varies in size and involution forms are common.

Motility: Apparently absent. Brownian movement marked.

Sporulation: None observed.

Aniline Dyes: Stains fairly well. Bipolar staining frequently observed. Gram, negative.

Growth: Moderately rapid in incubator. Agar plates, small, spherical, glistening colonies and of a bluish tinge.

Gelatine Stub: Growth along the entire line of inoculation. Surface growth flat and slightly spreading. No liquefaction.

Streak Cultures: Agar bluish white, glistening spherical colonies which coalesce and form a rather thick surface growth.

Loeffler's Blood Serum: Rather thick greyish white growth. Potato growth slight and invisible.

Bouillon: Growth scant. Medium becomes slightly cloudy.

Litmus: Colored mannite, maltose, glucose, dextrin and levulose beef tea became acidified. The alkalinity does not return. Lactose and saccharose beef tea show a slight temporary reduction of the litmus. Gas is not produced in any of these media.

Milk: Slight acidification has been observed. No coagulation.

Pathogenesis: Guinea pigs suffered no ill effects on intraperitoneal injections of large quantities.

There is a germ described by Zur Nedden, to which this germ may be closely related. I have not had access to Zur Nedden's original article (*Klin. Monats. bl. f. Augenheilk.*, January, 1902). The organism is described in Koll and Wasserman's *Handbook der Pathogen. Mikro-organismen*, Vol. III, p. 574. This germ differs from the one which you have isolated, in that it coagulates milk, forms a thick yellowish-brown growth on potato and its gelatine stab characteristic is a flat nail head, limited to the upper part of the stab.

I would be very much interested in knowing the appearance of your germ in stains of the fresh material from which it was derived. With best regards, I remain,

Very truly yours,

DAVID G. LEVY.

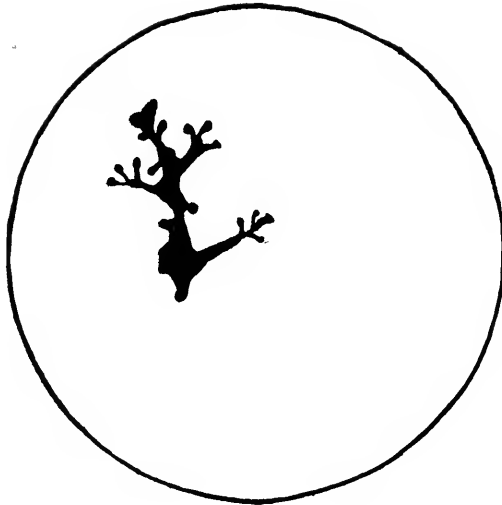
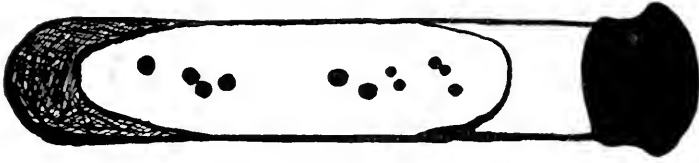


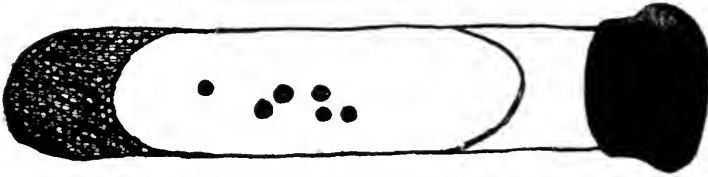
FIGURE 1. Joe Belden. Dendritic Keratitis of Right Eye.  
September 4, 1904.

Cultures on Loeffler's Blood Serum taken from Conjunctival Sac.



Colonies are round, flat, depressed and white.

Colonies on Loeffler's Blood Serum taken from corner of R. E.



Colonies are round, flat, depressed and white.

FIGURE 2.

Our textbooks are rather brief upon the pathology of dendritic keratitis. Hence this is submitted, that others seeing like cases may be induced to proceed as above, for possibly dendritic keratitis may have its etiology lodged in what appears to be a new germ. Dendritic keratitis is very infrequently seen by me. The treatment consists in the application to the ulcer once daily of absolute alcohol. Atropia in a 1 per cent solution was also instilled and the ulcer frequently irrigated with warm normal saline solution applied in a fine stream directly to the ulcer surface.

He recovered in four weeks with a scar marking the spot of the former ulcer. Internally he received the fresh syrup of the iodide of iron.

## DISCUSSION ON

## REPORT OF A CASE OF ELECTRIC OPHTHALMIA.\*

BY EDWARD B. HECKEL, M. D.

PITTSBURG.

Dr. Ball (Warren, Pa.): I would ask what treatment, if any, was used for the intense pain caused by the exposure. Yesterday morning, before coming here, one of the Westinghouse employes in our town was subject to a sudden exposure of 3,300 volts, and had intense hyperemia of the conjunctiva, and very severe pain.

Dr. Ringueberg (Lockport, N. Y.): I had three cases after the last time we had a solar eclipse, in one of which there was at the macula a crescentic yellowish raised spot the shape of the visible portion of the disc, and corresponded to its appearance at about the time he looked at the eclipse; he permanently lost a little central vision.

Dr. Willetts (Pittsburg): I recall a gentleman, who, while heating a wire for his boy, over a gas flame, complained of a central scotoma of limited area. Ophthalmoscopic examination revealed no pathologic condition of the retina, and I told him that in all probability the retina would resume its function. At the end of three months the scotoma was still present, and later there was a pronounced central oedema. He went to New York and the case was diagnosed a possible albuminuric retinitis, and he was recommended to go to California, which he did, remaining about a year. That was all of ten years ago. The patient has completely recovered, excepting a slight vertical distortion of lines, and is at present engaged in active business pursuits.

Dr. Wood: Was the form of scotoma observed colored or white?

Dr. Willetts: If I remember correctly, it was white or yellowish.

Dr. Vail (Cincinnati): Some two years ago, a friend and fellow ophthalmologist desired to test the relative merits of two electric ophthalmoscopes, and I offered my eye for his test. He placed me in a dark room and subjected the eye to a long test with the two instruments, with a view of purchasing whichever he liked best. After the test was over and I returned to my office, everything

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\*See page 122.

looked absolutely purple to that eye. The color of my office was royal purple. The deep blue color was uniform over the entire field; objects with the other eye appeared normal. This condition persisted for an hour and a half, gradually becoming lighter in shade, until it was but a slight lavender color. The next day I could still detect a slight difference in the color of the whiteness of the card, as seen with my eyes single. The practical application to this, in my mind, has been, that if the eye, which was in a normal and healthy condition, could be given such a profound impression from the glare of an electric ophthalmoscope, what would be the effect of subjecting an eye affected with some form of deep-seated inflammation, like albuminuric retinitis, to the glare of an ophthalmoscope for an equal time? We are not fully conscious of the amount of glare an eye is subjected to in these cases. Our interest in the case causes us to lose sight of the harm which might be done with the ophthalmoscope. We should make our examinations as expeditiously as possible. The more expert you are, the more you can see in a short period. I know of some ophthalmoscopists who boast of spending hours in making an accurate drawing of the fundus. I am satisfied that positive harm may result from a protracted ophthalmoscopic examination.

Dr. Blackham (Dunkirk, N. Y.): I came here as a student, but I would like to refer to a personal experience. A great many years ago, when I was a good deal younger than I am now, there was to be a transit of Venus, and I was assisting the professor in charge of the Highschool to observe it with the school telescope; I was to do the examining to get the contact, and he was to take the time. When we got all ready, he had left the dark glass of the telescope at home, and I undertook to make these observations by putting on a couple of pair of smoked glasses, and I had much the same experience. That night I went down town, and it was about the time of the blue glass enthusiasm, and I thought the idea had surely struck town, for it seemed to me the stores were all illuminated with blue glass. This condition persisted for more than four weeks. I do not know that it injured my vision in any way, for the only pathological condition I was aware of was this blue vision, and it was confined to the right eye, the one with which I looked at the sun through the telescope. With regard to the paper, while it seems to me that the blistering of the skin was a simple case of burn, the scotoma was the direct result of the action of the light on the retina. I am curious to know, except as a placebo, what the strychnia has to do with the restoration.

Dr. Heckel (closing): I would say, in reply to Dr. Ball, that cold compresses and cocaine are the things to relieve the pain. The scotoma was positive, simply a blank spot, and from what he told me—I did not see him in the acute stage—I imagine it must have been about 30 or 45 degrees. When I saw him it was practically circular, and in looking at the  $20/20$  line, as he moved his eye along the line it was just large enough to include one of these letters. My chief object in reporting this case was to elicit some discussion on the probable changes which may have taken place in these retinae. We know quite a little about the act of vision; for instance, we know that the rods and cones are the light-perceiving stratum of the retina. We also know that the rods are directly concerned with visual purple, and we further know that there are no rods in the macula lutea. I think we know enough, however, to say that vision depends upon certain chemical changes, and that it is impossible to exhaust these and produce a partial or complete blindness. There may have been some changes in the anterior layers which prevented the light from passing through to the light-perceiving stratum of rods and cones. I believe it to be an exhaustion of those chemical elements necessary for vision. I do not believe the strychnia had anything to do with the restoration of vision, as I stated it was given on "general principles," but chiefly to keep track of the patient. I think this perfectly legitimate as long as it is for the benefit of the patient.







TRANSACTIONS

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AT ITS

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*St. Louis, Mo.*



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PROCEEDINGS  
OF THE  
**Section on Oto-Laryngology.**

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PRESIDENT'S ADDRESS.

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JURISPRUDENCE OF THE NOSE, THROAT AND EAR.

BY HANAU W. LOEB, M.D., ST. LOUIS, MO.

The rise of specialism has resulted from the great extension of knowledge and the necessary detail which its understanding requires. In the good old days of Plato and Aristotle, one man could encompass the field of knowledge, but as it has broadened in extent, divisions and subdivisions have become necessary until now there are a multitude of workers tilling small portions of this wondrous soil. Modern experience has shown that to do justice to even the smallest of sub-divisions, a man must devote his entire energy to it; even then, to grasp it well he must constantly narrow his study or it eludes him. Out of this process of concentration of study and devotion to details have grown the various special branches with their exponents who are ever-extending their investigations, yet ever-narrowing their work in life.

This division of knowledge and restriction of work are exemplified in medicine perhaps more than in any other field of human activity. To say nothing of the laboratory departments of medicine, there have been developed in the last quarter of a century, numerous specialties which have in turn grown with remarkable rapidity. I need but ask you to look at our own lines of work to demonstrate how extensive has become what was once but a minute portion of the vast fabric of medicine.

We must confess that, desirable as this is for the development and understanding of knowledge, it is not an unalloyed good. The very process tends to make us mechanical rather than philosophical, routinists rather than research workers, followers rather than creators.

And so great has become the mass of accumulated facts in any branch of medicine, that but few men are equal to the task, unless their interest be real and their activity continuous. Difficult as it may be to keep up with the progress in any line of work, we must accept the challenge which knowledge has thrown to us, the gage of battle which truth forces everyone to take up before she is to be discovered.

And yet if we do our full duty we must not forget the world of knowledge around us, the world of truth which has been uncovered by the hard efforts and determined struggles of men in other fields.

On the borderland there is much that influences medicine for the profession and humanity. Beyond this border we must constantly look, and learn from what we see. Along the confines of medicine there is no more interesting study than jurisprudence. Important in its relation to medicine, it enters into every specialty and manifests its bearing upon every branch of the profession. It is this subject of medical jurisprudence as it relates to the nose, throat and ear that I have selected as worthy to bring before you in acknowledging the high distinction with which you have honored me.

The study of legal medicine in its relation to the nose, throat and ear is not much encouraged, especially in this country. The reason is not far to see. Physicians are averse to court service. They object to the catechism to which they are subjected by attorneys. They fear the false position in which they may be placed, either from questions which they answer on the spur of the moment or from the false construction placed upon their answers by judges, juries and attorneys. Besides this, the interference with other duties, the delays and vexations of court attendance and the publicity all have their weight in making this work most distasteful.

But these conditions are inadequate to justify a lack of interest and attention, especially where public duty is at stake. Shall we shirk it because it is difficult, trying, unpleasant and prejudicial to our reputation? Diphtheria, atrophic rhinitis, tuberculosis, scarlatina and other conditions which affect the nose, throat and ear fall within the same category, but shall we refuse them our aid on this account? Shall we not rather welcome the opportunity of doing our full duty in spite of the dangers, trials, discomforts and annoyances to which they subject us?

In matters of jurisprudence the physician is called to perform certain functions. He is asked to give advice, to counsel on matters affecting a client, he is called upon by attorneys and by courts to

make examinations with a view of subsequently giving opinion in court and he is asked to give an opinion as an expert after hearing the complete testimony of a case in action. There are some essential differences between the testimony of experts and the testimony of ordinary witnesses, but in this country the lines are so imperfectly drawn that one judge may rule that an expert is not required to testify upon just such questions as another judge would force him to answer. In England, according to Tidy, no man can be compelled to testify as an expert. In this country one may be forced to testify against his will; however this rights itself in that very few attorneys would agree to accept the testimony of an unwilling expert.

The variety of questions which arise in connection with this duty of a physician as an expert is manifold indeed. In the continental countries of Europe, a large portion of the subject is devoted to the army, where by reason of the compulsory army service, physicians are frequently called upon to determine the validity of the prospective or enlisted soldier's claim to exemption from service; in this country, this is but a small feature.

We are far more concerned with damage suits. In most of the continental countries the laws are specific as to the indemnity, and opportunity for bringing suit is lessened by the strictness of the government and the inadequacy of funds on the part of the poorer portion of the community. Here where we have so much freedom, anyone whether he be rich or poor may bring suit, and he may obtain ample legal assistance whether his cause be just or not. As indicated in a recent magazine, "The Profession of Getting Hurt" is becoming an extensive one, in fact a serious one, and the resources which trickery and blackmail are utilizing make it a decided menace to corporations and business interests.

In criminal matters the testimony of the laryngologist and otologist is sometimes of great importance, for a painstaking investigation of the condition of the ear, nose and throat may throw light upon the guilt or innocence of the defendant.

There is a large variety of nose, throat and ear affections to which the medical expert must refer in the performance of his duties. It is remarkable how wide-spread are the questions involved and how important they become. The nose is not often concerned in causes of legal action. Fractures of the nasal bones, fractures of the septum, contusions and wounds of the nose are naturally brought into play. Suits have been introduced based on the plea that a chronic affection of the nose resulted from an accident. Loss of the

sensation of smell has often been claimed to have been due to an accident. The accessory sinuses may be made a matter of consideration either in the way of direct injury or in disease resulting from accident. A manifest chronic suppuration is sometimes held to be of traumatic origin. These claims are brought forward not by malingerers alone, but by those who are honestly mistaken as to the cause of their ailment.

The throat is a far more important organ in medical jurisprudence. Traumatism may affect the pharynx or larynx and may thus be brought to an issue in court. Fractures of the larynx, which are very uncommon, are nevertheless to be considered. Criminal jurisprudence has much to do with wounds and fractures of the larynx, while many associated conditions in which the larynx is involved are matters of medico-legal interest. Thus, sudden death by respiratory obliteration is often a question, for death may result in infants and demented from the entrance of the alimentary bolus into the larynx or trachea, and asphyxia may occur through arrest of the mass at the upper extremity of the esophagus by pressing against the membranous wall of the trachea. Suffocation may be caused by gastric ejecta entering the larynx. Fatal inhibition may have its point of departure in the respiratory passages, for sudden death supervenes upon operations of no unusual gravity upon the nasal fossae, pharynx and palate.

Strangulation is another question which must interest the student of jurisprudence of the larynx. It may result from external force, applied by the hand or by bands, ropes, etc., such as in hanging. Death may occur even if the external force be only moderate, doubtless from reflex action or inhibition. Suffocation may result from the application of the hand over the nose and mouth or from the use of some other agent which prevents the air from passing into these two organs. It is remarkable how much resistance is exhibited by young infants and animals who are subject to this practice. Cases have been reported where infants have been recalled to life after an exceedingly long period of suffocation.

Drowning, which, according to Castex, comprises one-third of the cases of accidental death and one-fourth of the suicides, becomes of much interest in so far as the effect on the nose, throat and ear is concerned. It is not necessary that the entire body should be covered with water, as death may follow when the nose and mouth alone are submerged.

The throat is concerned very often in simulation where an attempt is made to obtain damages. Claim is not infrequently made that



loss of voice follows accident as a result of the concussion or direct violence. Sometimes absolute mutism is affected and simulated for a long time. In a case that came under my observation, the plaintiff claimed that the accident caused a loss of her singing voice without affecting her speaking voice. As it was easy to prove that there was no loss of musical sense in her case, and as she claimed to have lost her ability to whistle at the same time, it was readily established that she was simulating.

Hysterical affections of the larynx may follow accidents just as other symptoms of traumatic hysteria. In one case, to which I shall later make reference, it was easy to demonstrate the presence of hysteria of the larynx, shown in the aphonia, one-sided paralysis of adduction and hemianaesthesia of the larynx.

The ability of a singer or speaker to fill a contract is sometimes brought before a laryngologist for expert opinion. Through disinclination, pique or other reason, the artist may refuse to fulfill the agreement claiming that some affection of the vocal organs prevents. The expert is here required to make very nice distinctions and close study in order to give an opinion which can be accepted as final and which will be just to both parties concerned.

Jurisprudence of the ear offers ample opportunity for study. Traumatism of the ear have been most extensively investigated with reference to their bearing on medico-legal questions. Röpke found that out of 45,719 accidents, there were 57 which concerned the ear. Tommasi presents a most extensive investigation upon this subject, in recent numbers of the *Archives Internationales de Laryngologie, D'Otologie et de Rhinologie*. They include every variety of simple incised, contused and infected wounds, gun-shot wounds, fractures, burns, traumatism to the external and middle ear, labyrinth, mastoid, membrana tympani and other structures of the ear. Suppuration must be carefully considered with a view of determining whether it preceded the accident or resulted from it or occurred later without any dependence on the accident. The deafness present must be investigated likewise, so as to establish whether it was antecedent or resultant to the accident or independent of it. Similar observation must be made with regard to tinnitus and vertigo. It must not be forgotten that even the most conscientious plaintiff will magnify these conditions.

Ear lesions result from hanging, though there is some discussion as to whether they are produced post-mortem at the moment after the body falls when the rope is cut, or at the time of the hanging. Lagroux and Gelle, experimenting on dogs killed by hanging and

strangulation, found bloody suffusions in the tympanic cavity. Explosions; particularly from dynamite are very apt to cause lesions of the ear such as rupture of the tympanum and dislocation of the ossicles, hemorrhage into the tympanic cavity, while symptoms of tinnitus and deafness may follow.

Neuroses of the ear are not often brought into question in connection with medical jurisprudence, though hysteria is occasionally a matter of some importance. A case in which I was called as an expert presented an opportunity for demonstrating the presence of hysterical deafness. Following an accident of a very serious type, Mrs. M. had been taken with a most aggravated form of hysteria with symptoms of complete hemianaesthesia, phantom tumor, etc. I was called to see her by Dr. Schwab of St. Louis, in consequence of a suddenly developed aphonia which readily disappeared under a plan of suggestion, recently described. Several weeks later she complained of sudden and complete deafness on the affected side. Examination showed no hearing for watch, whisper or speech on the left side. Weber lateralized to the right, tuning fork by air nil, by bone, heard in the other ear. It was clear from this that if she told the truth as to the tests she could absolutely not hear in the left ear. Examination of the right ear showed impacted cerumen. This was washed out and the tests repeated. As soon as the Weber and Rinne tests were made the woman burst out crying, claiming that I had caused her to lose her hearing on the right side, demonstrating to my mind, at least, that she was not in any sense feigning and that the lateralization of the Weber and Rinne tests to the right side was truthfully expressed. The plug of cerumen naturally intensified the sounds in these tests. No simulator, unless specially instructed in otology could have known that washing out the cerumen would lessen the appreciation of the Weber test. The woman soon made a complete recovery from the deafness, but the other hysterical symptoms continued, and she eventually died still suffering from traumatic hysteria.

The detection of simulators of deafness has been so very well brought out by ingenious test contrivances, that practically no one can continue the deception, when full opportunity is given for examination. The well-known experiment of Weber is utilized, with its unexpected results following the occlusion of the healthy ear with wax. The lateralization of the sound in chronic middle ear affection is a phenomenon which few simulators are prepared to encounter.

A variety of tests can be made by plugging the ear with a solid mass and following it with a hollow body which permits the air to

come in contact with the drum. By ringing in changes suddenly it is often possible to detect the simulation. Several methods have been devised upon the plan of speaking into tubes placed in the ears of the individual tested. By compressing the tubes from time to time it is possible to determine which ear is competent to hear without the simulator being able to follow the changes. If two persons speaking into the orifice of the tubes ask questions simultaneously, one in each ear, the person suffering with unilateral deafness will answer, without hesitation the questions asked through the tube of the unaffected ear, while the malingerer will be overcome with confusion. If two persons possessing a similar quality of voice speak into the two tubes, it will be easy to detect any simulation by exhibition of even a little ingenuity in this regard.

Simulation of deafmutism is far more common in the army and naval service than in civil suits. Some very well sustained instances of simulated deafmutism have been reported. They generally fail, however, by close examination of their characteristics, habits, writing, etc. The deafmute, when he knows that some one is speaking to him is all attention and does not permit a single gesture to escape him. The false deafmute never notices the faces of those who speak to him and keeps his eyes lowered as if he were afraid that they would betray him. The attitude and gestures are exaggerated and unharmonic, showing his constraint (Lamois). When the simulator is asked to write he is almost certain to betray himself if he admits an ability to write. Deafmutes trained under the older methods have few if any abstract ideas, hence what they write must indicate concrete concepts. Thus Gogguilot cites the case of a malingerer who wrote "*je suis sourd et muet, je n'ai pas de moyens d'existence . . .*" A deafmute would never say he needed the means of existence. He would say he had no more bread or no more money or could do no more work. Under the modern methods of training, deafmutes acquire a much higher order of ability to write. Evidence as to this of course could readily be determined.

Not the least interesting question that comes up in connection with this subject is the standing of a deafmute before the law. Until Napoleon's time the deafmute had a very trying position on the continent of Europe. According to Castex the Roman law was cruel to the deafmute who was not permitted to dispose of his person or goods and was ranked with idiots and the insane for the conduct of his affairs. Most of these deficiencies have been eliminated and in the main the deafmute has a position dependent upon his intelligence.

From the multitude and variety of subjects involved, it must be certain that the ear, nose and throat have an importance in medical jurisprudence which justifies an earnest study. It is intertwined with every branch of the subject and its exposition progresses with each advance made. Its fibre forms a portion of otology and laryngology without which the fabric is incomplete and the weave defective. Shall it still rest as a burden for those who are willing to bear it? Shall it interest only those whom accident or opportunity forces into action?

I appeal for more regard for this work, however distasteful it be; for more courage in undertaking it, however prejudicial to reputation it may become; for more willingness to accept it, even though it is always trying, annoying and time-consuming.

The same high principles are to guide us in answering this appeal that, from the earliest times, have been burned into the soul of all true medical men: to speak the truth, to do no man harm, to hearken to the call of duty, to shun all boasting and to give ear, heart, hand and tongue to all that will further the well-being and good of mankind.

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## FORMALIN IN THE TREATMENT OF DISEASES OF THE EAR, NOSE AND THROAT.

BY OTTO J. STEIN, M.D., CHICAGO, ILL.

In presenting this subject it is unnecessary for the purpose of the paper to enter into the chemistry or the physiological properties of the drug.

Formalin has already won well-merited recognition as a powerful germicide, disinfectant, deodorant and antizymotic. Its most valuable qualification is that it is so actively germicidal in such infinitesimal dilutions, and as such is harmless to the vitality of the cells. The power of its antiseptic properties, its effectiveness in very dilute solutions, the simplicity of its application, its ready solubility, its cheapness and its comparative harmless nature have indorsed its wide employment. It is a preparation readily procurable anywhere; can be kept for a long time without deterioration; in proper dilutions is almost painless and odorless, and is not injurious to fine fabric or to instruments.

I was first led to employ this drug in a case of long standing muco-purulent discharge of the ear, and was so pleased with the immediate results obtained that I began using it in a variety of ear affections. It demonstrated its worth as a drug to prevent the growth of and as a power to destroy bacilli. As a means to prevent the development of the bacteria of putrefaction, and to prevent the growth of the various parasitic growths found within the auditory canal, in otomycosis, it has no equal. Most gratifying results will be obtained when used to check the foul odor existing in many cases of chronic suppurative ear disease.

From the results obtained in the treatment of certain affections of the respiratory passages, we have ample proof of its effectiveness as an antiseptic. Excellent results have been secured in the treatment of whooping cough and pulmonary tuberculosis, but I have had no personal experience with it in either of them. In the anginas accompanying the various exanthemata, and in diphtheria its employment is apparent. In tubercular laryngeal disease it is to-day one of the best means we possess for treating this affection. Personally I have used it in the various manifestations of the disease many times, and the conclusions I have arrived at after this experi-

ence warmly endorses its employment in such affections. It has been recommended in the infiltration stage of the disease by direct injection into the infiltrated area. I have not used it in this way. But in the ulcerative stage it certainly exerts most promising results. It is my practice to first cleanse the ulcers, then spray a ten per cent cocain solution into the larynx, to be followed in five or ten minutes with a cotton applicator well moistened with a five to ten per cent solution of formalin in water. The previous application of the cocain robs the patient of any smarting otherwise present as a result of the formalin. The treatments are repeated two or three times a week, and never result in any unpleasant symptoms. Many different combinations of formalin are used, but my method is to dilute with water. A solution suggested by Lake has proven successful in some hands. It is composed of carbolic acid, ten parts, formalin ten parts; lactic acid, fifty parts, and water thirty parts. Paraform, a powdered form of formalin, can also be used.

Formalin may be incorporated in mouth wash and gargle solutions in the strength of one half per cent. In the lacunar type of tonsil disease it can be used in from two to five per cent solutions. A one to two per cent solution can be used in the various manifestations of nasal disease, like tubercular and syphilitic ulcerations, atrophic rhinitis with ozena and in suppurative sinusitis. It is advisable in all such cases to first clean the affected surface, and then apply a two or four per cent cocain or eucain solution, in order to obviate the pungent effect of the formalin. In vaso-motor rhinitis Ballenger incorporates the cocain with the formalin as follows: Formalin, one-half per cent; cocain, two per cent; and he then makes but one application with a spray.

Formalin, in solution with water or alcohol, used by injection into malignant growths and inoperable tumors about the nose, throat and naso-pharynx, has been reported used with success. I have never used it in this way. We have used this drug in a great number and variety of cases, but not wishing to trespass too far on valuable time, perhaps the recitation of a few cases will convey an idea of the broad field of application, the rapidity of action and the beneficial effects obtained from the employment of this drug in affections of the ear, nose and throat.

Mr. B. Otomycosis. From the history given by the patient he had been under the treatment of a Chicago confrere off and on for six months. Examination of the ear showed pieces of soft masses, in part desquamated epidermis, of a dirty white color, and other

masses of a white color covered in places with black particles. On the posterior part of the drum membrane was one small phlyctena. After opening the phlyctena and cleaning and drying the canal thoroughly, a narrow strip of plain gauze was inserted, filling the entire canal loosely. On the outside of this two drops of a ten per cent formalin solution was dropped, a piece of dry cotton fitted into the meatus, and the latter then sealed with collodion. On the second day this dressing was removed, and the improvement was so great as to make further application of the formalin unnecessary. Within a week this case was dismissed, and when seen four months later there was no sign of a recurrence.

In this case the conditions present responded exceptionally quick to the treatment. It is more often necessary to repeat the application two, three or four times, at intervals of two days.

Where the skin of the canal is very delicate or already inflamed from the discharge present, or where either too strong or too much of the formalin solution has been used in moistening the outer end of the gauze, a slight irritation of the skin around the meatus may occur, but otherwise nothing unpleasant results.

Miss Helene B., 25 years old; Chronic suppurative otitis media, bilateral, since childhood. The right drum membrane entirely destroyed, and in the left a large central perforation. After treating the condition present, including the removal of some adenoid tissue, and an ossiculectomy of the right ear, there still existed a slight discharge. Five applications of a five per cent solution of formalin, at intervals of four days, resulted in a cessation of the discharge, and there has been no return after eleven months. Where the perforation is very large, as in this case, the formalin solution is instilled directly into the ear, and left there for five minutes. After which the parts are thoroughly dried and plain dry sterile gauze inserted. Some patients complain of a sharp pain lasting not more than one or two minutes after the formalin application. In such cases I may precede the treatment by the instillation of one drop of a warm ten per cent cocain solution.

Helen M., 15 years old. Chronic mucopurulent middle ear disease. The history of an intermitting discharging ear in this case extended back to childhood. The secretion was chiefly mucus, very copious, and had its origin from attacks of Eustachian salpingitis, which in turn was provoked by a general lymphoid thickening about the oro and nasopharynx. Formalin was used in this case, after trying many of the well known drugs, with the idea that possibly an

astringent effect might be obtained. Applications were made with a intratympanic syringe, half full, directly into the cavum tympanum, the fluid coming out through the tube into the throat. At first a two and a half per cent solution was used, but this proved too painful to the patient, who is over sensitive, and I reduced it to a one and one-fourth per cent solution. After the second application all discharge ceased but appeared again, in very slight amount, within a week, but which in turn was checked by two more injections.

Mr. R. D., 35 years old. Chronic suppurative otitis media of left ear for five years; cholesteatoma in middle ear, and a most offensive odor to the profuse discharge. This case was one for surgical intervention, but consent could not be obtained, and therefore the treatment necessarily was only one of cleansing. A formalin solution of five per cent, and often ten per cent, was used, which readily changed the character of the secretion to a watery nature, reducing it in amount so that only a very little collected in the period of three or four days, and the odor was absolutely dissipated. With a reduction of the discharge to the minimum, so that the hearing improved, and the sense of heaviness disappeared; with a total absence of any odor and with the spirits of the patient immensely improved, the instillation of formalin in this case brought about as good results as I expected.

Dr. Joseph Mullen of Houston, Texas, drew my attention to the employment of formalin in a manner quite novel and entirely new to me. Since reading his report upon its method of application I have followed his directions in four cases with entire satisfaction. The method of using it in septic mastoid cases is as follows. The formalin, full strength, is dropped on the outside of the dressings, on a spot marked with an indelible pencil indicating the location of the external meatus. The nurse is instructed to drop about twenty drops of the solution on the dressings three times a day. After removal of the dressings on the fifth or sixth day the wound looks clean and healthy; there is an absence of pus and foul odor and as a consequence the temperature remains near the normal. That the influence of the drug is felt is readily determined by the strong odor of formaldehyde gas that permeates all the dressings down to the middle ear cavity.

Mr. R. T.; 37 years old. Laryngeal tuberculosis in which the first laryngeal symptom, that of hoarseness, manifested itself six years ago. The pulmonary changes have not advanced much. The cough is severe; expectoration difficult; swallowing painful, and the hoarseness very pronounced. The sputum showed quantities of



tubercle bacilli. Both vocal cords presented ulcerations on their upper surface involving the posterior half or more, and was associated with some edematous infiltration. At first a two and a half per cent solution of formalin was applied directly to the ulcerations. After a week a five per cent solution and in another week a ten per cent solution was used. After five weeks, a fifteen per cent solution was applied every fifth or seventh day. The patient was under observation for three and a half months, and showed a steady improvement in his condition, both local and general. The cough occurs only at long intervals, is easy and not in the least exhausting. His appetite is splendid and there is no discomfort whatsoever when eating or talking.

#### DISCUSSION.

DR. FOSTER, Denver: I consider formalin one of the most useful agents we have had given to us in a long time. It certainly has great advantages both in the way it can be handled, being one of the simplest to use, and also in its curative effects. I have used it frequently in purulent discharges from the ear, and there is no better disinfecting agent that I have ever employed. I think its use is very much limited in diseases of the nose unless you use cocaine, and I am greatly opposed to the constant use of cocaine. We run the danger of getting the patient in the cocaine habit. We do not know when we start them on the downward course, because it is a very seductive drug. Formaldehyde in sinusitis can not be used without cocaine preceding it.

I was interested in the remarks about tubercular laryngitis. We have a good deal of that out West. All the patients that can not be cured in your climate you send to Colorado. We get a great many of them. I think of all drugs this one is the best I have ever tried in these cases, but it must be used quite strong. You have to use it strong enough to compel the use of cocaine in the throat before applying it; because there is a great deal of pain in the use of formaldehyde. The physician can use it in the strength of two and a half per cent applied locally to the throat with a spray. But the use of formaldehyde does not stop there. The patient should spray the throat from one to two hours with a one per cent solution during the intervals of office treatments. We get better results in tubercular cases with this kind of treatment than with anything else we have ever tried. I do not think there are the disadvantages in using it that there are in many other general disinfectants, for instance bi-chloride, which has been its most formidable antagonist.

DR. MURPHY: To get these results do you ever use cocaine?

DR. FOSTER: Yes; where there is a great deal of pain.

DR. STUCKY, Lexington, Ky.: I used formaldehyde very freely some years ago but ceased, first, because of the pain and discomfort accompanying its use, and, second, because of the disagreeable dry sensation that followed its use. I am glad to hear Dr. Stein's method of using it, and I think I shall try it again. I have used it principally in the ear; and the excessive pain, the prolonged discomfort of several hours following it made me cease using it. Dr. Stein mentions preceding the application of five per cent formaldehyde with a few drops of cocaine, ten per cent, dropped into the ear. I have used as high as twenty per cent; but my experience is that a diseased ear does not absorb enough of the local anaesthetic to produce anaesthesia. I shall try again with the weaker solutions. I should like to ask Dr. Stein to enlighten us a little as to these two effects, the excessive dryness with even a half per cent solution on the mucous surface, and the pain following its use when instilled into the ear as strong as five per cent.

DR. HAL FOSTER, Kansas City, Mo.: I rise to endorse Dr. Stein's admirable paper. Many of our patients we can not send away, especially the poorer classes, and it has been my custom to use first ten and sometimes a stronger per cent of cocaine, in tuberculosis of the larynx, and then to apply two, three, four and even five per cent of the formalin solution. I am satisfied from experience in a good many cases that it is the best agent we have. It is far better than the strong lactic acid. Under the cocaine it does not give so much irritation, and it certainly gives the patients comfort and relieves the distressing ulceration in those chronic cases of tuberculosis of the larynx that we see in the last stages. I am satisfied that if used judiciously, it will certainly prove very beneficial in these cases.

DR. BALENGER: Dr. Stein has given me credit for using formalin in rhinitis when it really came to me from Dr. Conwell of Cincinnati. He used it on me. I had a hyperaesthetic rhinitis, was sneezing considerably, had been for three weeks, and this stopped it immediately. But I want to say to you that the sensation is very painful for about thirty seconds. Then it subsides. On account of the dryness, my nose felt very fine indeed; because, up to that time, it had been very moist and dripping and uncomfortable. I have used it a number of times with patients in this type or hyperaesthetic rhinitis. I do not use it in the ordinary type of rhinitis or coryza; but in the hyperaesthetic types of rhinitis I almost always have found that it gave immediate relief. In the ordinary type of rhinitis I doubt very much whether its use is judicious.

DR. STEIN (closing): My paper was necessarily short, being really more of a clinical paper. Therefore, I quoted only six cases, illustrating a variety of conditions; but formalin in my hands and the hands of my assistants has been used in several hundred cases. I never kept any record of them because we used it so systematically in the clinic and also in my private work; but in ear work especially I have noticed the greatest benefit. As far as the excessive dryness and the pain to which Dr. Stucky refers, I have never had any cause to regret using the formalin. Pain is often produced, lasting possibly not over two minutes, but I do not believe I have ever had a case in which I have used formalin after the method I mentioned yesterday in my paper, which produced pain lasting over two minutes, excepting possibly one girl with muco-purulent middle ear disease, the case mentioned in my paper. The girl was exceedingly sensitive, and at first I did not apply any cocaine previously; but afterwards I did, which mitigated the pain somewhat, although every time I used it she complained considerably over the two minutes. Ordinarily there is no complaint after a minute or two.

But the results you get from its use are worth the pain. As far as the dryness is concerned, really that is what I have been aiming at. I wanted the dryness in these ear cases. I have never had any cause to complain of that.

DR. STUCKY: You mentioned a form yesterday for local application in tubercular laryngitis.

DR. STEIN: It was Lake's well known formula. I can not recall the proportions exactly. I think it is 50 per cent of lactic acid, 10 per cent of carbolic acid, 10 per cent of formalin, 30 per cent of water. I think I am right. This Lake formula has been somewhat modified, but I think that is the original formula. You will find it in Lake's book.

## CYST OF THE THYRO-GLOSSUS DUCT. REPORT OF A CASE.

BY DR. JOHN J. KYLE, INDIANAPOLIS, INDIANA.

Persistence of the thyro-glossus duct is a subject of interest because of its comparative rarity, varied pathological changes developing from it, and the age at which a cyst of the duct may become manifest.

In the early embryonal life, the thyroid gland consists of three parts. The two lateral halves are derived from the endodermic lining of the fourth visceral furrow. The central portion of the gland is an outgrowth from the ventral wall of the pharynx in front of the second visceral arch, at the juncture of the basal portion of the tongue, and the anterior portion of the tongue developing from the tuberculum impar. The foramen coecum represents the median thyroid diverticulum, which elongates and as it bifurcates, occupies a position in front of the trachea, forming the isthmus of the thyroid bodies. The diverticulum which extends thus from the foramen coecum to the isthmus of the thyroid bodies, is called the thyro-glossus duct, or canal of His. About the eighth month of foetal life, this connecting band should be obliterated.

The location of a cyst of the thyro-glossus duct may be anteriorly, that is, near the isthmus of the thyroid gland, or posteriorly, or near the median line and at the base of the tongue.

In the greater number of cases reported, cysts of the thyro-glossus duct were situated anteriorly. The etiology of the condition is faulty embryological and foetal development, probably supplemented by traumatism.

The pathology is somewhat interesting, and according to Haeckel, "The contents of a cyst of the thyro-glossus duct is usually a yellow, mucoid substance. The cyst wall is frequently very thin and lined with ciliated epithelium and may contain definite thyroid substance." The tumor is usually movable and of slow growth. Following infection, rupture may take place with the formation of a permanent pustule, situated either anteriorly or posteriorly.

The symptoms vary greatly, according to the location of the cyst. If located anteriorly, there is a circumscribed swelling, varying in size from a small bean to a walnut, in the median line, beneath the deep fascia of the neck, and between the hyoid bone and the center of the thyroid cartilage. The tension of the tumor varies as

it grows and develops, being at first hard, and finally soft and fluctuating. There is little or no pain complained of when the cyst is located anteriorly, other than irritation produced by friction from collar or neck band.

A cyst may make its appearance at any age. Dowd (1) observed the condition in a child two years of age; Johnston (2) a case in a girl five years old; Armstrong (3) a case in a boy six years of age; Bazin (4) a case of eleven years; Barrett (5) one case at seventeen years; Payne, in a small child; Riesman (6) in a man of fifty-six years, in which a cyst had continued since the patient was eighteen years of age and resulted from traumatism; Senn (7) two cases varying from sixteen to twenty-five years; Robinson (8) in a patient fifty-five years of age, in which the cyst had persisted as long as the patient could remember.

In my own case, the patient, a woman forty-two years of age, first noticed swelling and pain four years before consulting me. At times the site of the cyst would become swollen and tender, with a sensation of wanting to swallow as if something had lodged at the base of the tongue, also at times, an expectoration of frothy sputa. The cyst would remain in this position varying from one to two weeks, after which it would apparently disappear, to return again at almost regular periods of a month. At times the menses were somewhat irregular. These attacks continued and grew worse, swallowing becoming more difficult and also smothering sensations at night from the swelling. From the above, it is reasonable to presume that the cyst though located anteriorly, emptied posteriorly. From the inflammation surrounding the duct, it was temporarily closed, and in consequence, the direction of least resistance was externally.

The cyst was opened by a physician about three years after its first manifestation, by a simple incision, after which it would refill and rupture spontaneously at irregular periods, varying from a few weeks to two or three months.

The symptoms of a cyst of the duct situated posteriorly, are somewhat more distinct than those situated anteriorly, and, as in the case of Johnston, may become so large as to press upon the epiglottis, producing dyspnoea grave enough to necessitate intubation. When located posteriorly, the cyst may be situated to the right or left of the median line, yet springing from a median structure. There will be circumscribed swelling, fluctuation, absence of temperature and difficult swallowing.

With the foregoing enumeration of symptoms, the diagnosis of an anterior or posterior cyst of the thyro-glossus duct is comparatively easy. It will be unfortunate if the histo-pathology of the disease is overlooked and simple draining only, is recommended. The condition has no tendency to spontaneous recovery and may from our knowledge of the etiology of a malignant tumor, predispose to some form of that disease. The contents of a cyst may be discovered by puncture. If a fistula exists externally, it is sometimes possible to force fluids which the patient can detect by the taste, through the duct and into the mouth. In the case of the author, the lysol solution when forcibly injected into the fistulous opening could now and then be tasted at the back of the tongue. In the absence of this test, the location of the cyst or fistula will suggest its character.

The treatment of cyst of the thyro-glossus duct is essentially surgical and consists in the complete excision of the cyst and its limiting membrane and healing by a slow process of granulation. In external cyst or fistula, the tissue should be dissected from the upper portion of the hyoid bone to the thyroid isthmus. The two extremities of the wound may be brought together by suture and the wound packed with strips of iodoform gauze. The packing should be changed daily until recovery is complete.

Cysts located internally are, from the location, difficult to treat. The treatment must consist in curettement and the application of escharotics.

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## DISCUSSION.

DR. TIMBERMAN, Columbus, O.: The reports of such cases as this are of a great deal of interest. There would be a good many difficulties to me in the diagnosis of such a condition as reported, specially situated in the region described. If I can look into an eye and see a persistent hyaloid artery and know that is about the only thing that can occur there, I feel pretty certain about that persistent embryonic structure. The difficulty in this condition would be to determine that it was a persistent embryonic structure, since it might form from almost anything, especially in the neck, where we have such an amount of lymphatic and glandular tissue. I have much respect for a man who can make that diagnosis.

DR. KATE WYLIE BALDWIN, Philadelphia: I have had two cases, one 15 and the other 25 years old, the latter a colored woman. In the case of the 15-year-old girl it had been enlarged all her life, but in the colored woman it had been noticed only for two years. In both cases, it was dissected out and the wound healed by first intention. There has been no recurrence, one two years, the other one year since operation.

DR. PERCY FRIDENBERG, New York: The diagnosis may be complicated where there are signs of acute inflammation. I am in doubt whether my case was an inflamed cyst or merely the retention of septic matter at the base of the tongue. It was a case of a young adult, coming on suddenly, with intense pain in both ears, great difficulty in swallowing and some pain at the base of the tongue; but the pain in both ears persisted to the last. Hearing was not affected at all; there was swelling of both submaxillary glands. He could hardly open the mouth sufficiently to take food, but after making two fruitless attempts, I succeeded in passing a bistoury into the depths and evacuated a quantity of foul-smelling pus, after which the pain in the ears disappeared within two hours. The pus was intensely foul and the boy nearly vomited every time he brought up a bit of this pus afterwards. The question is whether I had to deal here with such a case as described by the essayist.

DR. KYLE (closing): I want to thank the members for their discussion of my paper. My results were perfectly satisfactory. The operation was performed something like fifteen months ago and the patient has remained well.

## TONSILLAR TISSUE. SHOULD IT BE REMOVED IN ALL CASES? WHY?

BY GEORGE W. SPOHN, M. D., ELKHART, INDIANA.

In treating this subject, tonsillar tissue has been considered as a part of the lymphatic system. There are two kinds of lymphatic bodies:—those that are regular in formation, and those that are irregular in formation. The former are true lymphatic glands. The latter are mere masses of lymphoid tissue. Both belong to the lymphatic system, and no doubt, both have the same physiological functions.

The true glands consist of a capsule of connective tissue, from which are given off trabeculae of fibrous tissue. The fibrous layers act as partitions and pass towards the center, dividing the gland into various divisions. The center of the gland is made up of a loose and retiform structure. Many of the principal lymphatic glands have ducts leading to and from them. It is often difficult to locate glands and their ducts, unless they are diseased.

The irregularly formed bodies of lymphoid tissue, are made up of a retiform structure, very similar to the center of true lymphatic glands. Instead of ducts, they have sinuses, through which the circulation is carried on. Lymph, circulating through lymph bodies or glands, is modified; toxines and bacteria are either neutralized or destroyed.

The histology of lymph bodies, does not differ in structure, from tonsillar tissue. They bear the same relation to each other, that one gland bears to another. The afferent vessel of one may be the efferent of another. In function and structure, they can not be separated.

The glandular tissue between the pillars of the fauces, in the pharyngeal vault, at the base of the tongue, in the ventricle of the larynx, and within the nares, is generally, known as tonsillar tissue. Formerly the word tonsil, referred only to the faucial glands. In fact, at present, the laity and very many general practitioners know of no other tonsils. Tonsil refers to a small lobe or almond shaped body; as the small lobes on the lower surface of the cerebellum. It does not mean gland. There is no good reason why this glandular tissue should be called tonsillar.



If the various tonsils were known as regional glands, it would simplify the subject very much, and would give the physician greater influence with his patients. The laity views the tonsil, as being just as essential to the general anatomy as any other part. Tonsillitis is such a common disease, that repeated recoveries have removed much of the dread of the disease. Enlarged cervical and lingual lymph glands receive immediate attention, because the laity has been educated, that diseased lymphatic glands are liable to become tubercular. If the word tonsil, would be stricken from our anatomies, and the terms, faucial glands, pharyngeal glands, lingual glands *et cetera*, substituted, the laity would soon learn that a diseased gland in the mouth needs treatment just as a diseased gland elsewhere.

The faucial gland, situated between the pillars of the fauces, resembles in structure the true lymphatic glands. It is covered with mucous membrane and has trabeculae of fibrous tissue that divide it into various divisions. It is composed mostly of lymphoid tissue, contains follicles and crypts, and is very vascular. The pharyngeal and faucial glands have a histology, very much the same. Their lymph circulation is carried on through sinuses. The pharyngeal is often nodular and irregular, even when normal; it is then often mistaken for a pathological condition. The lingual, laryngeal and nasal glands are mere masses of lymphoid tissue. The Waldeyer or lymphoid ring would be entitled to about the seventh tonsil. This would be on a par with the rest of the tonsillar nomenclature.

Tonsillar tissue does not develop in early childhood. The child is born with this tissue, as it is with any lymphatic glands, but it seems to be inactive. Is it possible, that these glands are allowed to remain latent until nature has a demand for them? There are certain pathological conditions of the system, that brings them to active duty, very early. This would indicate that their growth depends upon the needs of the system. Through the kindness of professional friends and their patrons, I have been able to examine the noses and throats of over one hundred infants, soon after birth. They were all children of good families whose histories were excellent. Of this number, not one had a tonsil that was perceptible. There was no elevation, not even a roughness between the pillars of the fauces. To the finger, the mucous membrane in the faucial cavities was smooth but firm. As stated before, the inactive or undeveloped state of tonsillar tissue seems to apply to lymphatic tissue generally. At the age of puberty, when there is a special demand for glandular activity throughout the system tonsillar tissue is most active.

In families where there is a tendency to catarrhal diseases of the mucous membranes, tonsillar tissue develops early in life. Often at the age of eight or ten, and sometimes as early as three and four. In strumous and syphilitic children it not only develops early, but it is often diseased at birth. I removed the adenoids from two children, respectively, two and four weeks old, in whom the symptoms had been dangerous to life. Would this not indicate that the glands become more active as the general system needs their functioning power? Lymphatic tissue is a cleanser, a scavenger to the whole body. Over taxation of it, does not only cause disease of the glands, and removes their protection to the system, but it also opens the portals for micro-organisms to enter the lymph circulation.

The function of the tonsils has never been positively established. It was formerly supposed, because of the epithelium covering the mucous membrane, that they had no power of absorption; but this has been proven to be otherwise. It has been shown by investigators, that by putting methylene blue in the crypts, and later removing the tonsils, they could demonstrate particles of the drug distributed all through the tonsils. Iodine has been injected into them and later detected in the urine. In fact, it has been suggested by some authors, to treat enlarged cervical glands by injecting iodine into the tonsils. This seems plausible, as the afferent ducts would carry the iodine from the fauces to the enlarged lymphatic glands.

As before stated, the structure of lymph bodies and tonsillar tissue is very much the same. Again, one of the functions of lymphoid tissue is to arrest and destroy toxins and micro-organisms. This, then, would show two quite definite functions for tonsillar tissue: 1. Absorption. 2. Arrest and destruction of toxins and pathogenic micro-organisms.

It is claimed by some writers, that the tonsils secrete a viscid fluid, that aids lubrication, deglutition and digestion. This may be true, but it has never been proven, and it is doubtful if it can be. As glands, tonsils are physiological. Their minute anatomy can not be disputed, though there are some who doubt their physiology.

If tonsils are to stand as guards in the oral cavity to prevent the entrance of micro-organisms into the circulation, then they should not be sacrificed by the surgeon if he can avoid it. It is possible that the surgery of the tonsils has been overdone. It is limited almost entirely to the faucial and pharyngeal regions. Inflammation and hypertrophy do not necessarily, indicate removal. The wholesale extirpation of tonsillar tissue should be discouraged. Ordinary inflammations can generally be cured by treatment. In-

inflammations are due to micro-organisms, of which the streptococcus, staphylococcus, diplococcus and Klebs-Löffler bacillus are the most frequent.

Very often tonsillar inflammations are indirectly caused by gout, rheumatism, digestive and menstrual troubles. Rheumatic tonsillitis is a common disease. It is a general disease with a localized trouble which should have both internal and local treatment. The local treatment should be continued, after convalescence, otherwise, they will become chronically inflamed and fail to perform their physiological functions.

There are many remedies that are useful in overcoming inflammations; but perhaps, no one remedy is so useful as iodine. This in glycerin, which is quite frequently used, can be of but little utility in any inflammations. Because, of its hygroscopic action, glycerine absorbs moisture from the tissue, that is it establishes exosmosis. This will reduce inflammations, but through the action of glycerine and not the iodine. The pure tincture is a desirable preparation which can be applied daily to inflamed tonsillar tissue with excellent results. It is so penetrating, that one application will often abort an attack of tonsillitis, when it is only local. Its application is very painful, unless it is preceded by an application of cocain.

Repeated acute attacks of tonsillitis, unless properly treated, will result in a chronically diseased tonsil, from which there is no relief, only enucleation. But the removal of the faucial glands, does not wholly stop inflammations in and around the faucial cavities. Clinical experience, has shown that there is less pharyngeal trouble after a thorough enucleation than before. Still, there are certain constitutional conditions which manifest themselves in pharyngeal inflammations.

Experience has taught that it is rare to find a tonsillitis and a diarrhoea at the same time; but it is a frequent occurrence to find a constipation associated with inflamed glandular tissue. Constipation, or auto-intoxication, is often the cause of tonsillar inflammations; or it is the result of micro-organisms, taken into the general system, through diseased tonsillar tissue. If the former, no doubt it is caused by the absorption of toxins from the alimentary canal. But why should the glands in the oral cavity become inflamed when the disturbing causes of the disease entered the system elsewhere? There may be a susceptibility, or there may be an idiosyncrasy. It is also possible that it is due to the phagocytic action of glandular

tissue. From their exposed positions, tonsils are more irritated by foods and air than other glands, hence they would be more liable to disease. One tonsillar inflammation predisposes to other attacks. If toxins and micro-organisms, circulating in the blood, cause tonsillar inflammation, then it must be due to the efforts of the glands to neutralize or destroy the poisons. If this be true, then, tonsillar tissue has another function, viz.: phagocytic action on auto-toxines.

If tonsillar tissue has such important physiological functions, then it should not be sacrificed to the knife unless absolutely necessary. Tonsillotomy is such a common operation in the eyes of the general physician that it does not have the dignified standing it deserves. If done correctly it is not an easy operation; nor is it devoid of danger. If the indifferent surgeons would enucleate and not decapitate, they would have more respect for the operation. The good results would more than recompense them for the extra trouble and anxiety.

The most active period of tonsillar disease, is from sixteen to twenty-six. The least active, is during childhood and old age, or before ten and after fifty.

If oral glands become chronically diseased, if they remain hypertrophied or hyperplastic, removal only, will give relief. The question is often asked, should the whole faucial tonsil be removed? All the lymphoid tissue should be removed, but the fibrous portion of the gland should be retained if possible. If the hilum and all the fibrous portion of the gland at the base is allowed to remain, there will be less contraction. If the enucleation is complete, that is if the whole gland is taken out, down to the muscle fibers, the pillars often become so contracted, that they form a pouch for the lodgment of food. The contraction might also, interfere with the physiological functions of the pharyngeal muscles. There should be left enough of the hilum to partially fill in the space between the pillars.

Tonsillar tissue should be removed: (1) when its pathological condition can not be cured with treatment; (2) when it obstructs the nares and oral cavity, or interferes with their physiological functions.

A small diseased tonsil, very often causes more trouble to the general system, than a large mass. Diseased adenoids may not obstruct nasal breathing, and yet may cause digestive troubles that impair the general health. It is a common thing, to find a severe cough caused by enlarged lingual tonsils. Dependence can not be put upon the subjective symptoms of a patient, whether a tonsil is diseased. The trained eye of the experienced physician should be

the guide, whether it is diseased and whether it needs operation. Lymphatic glands or tonsillar tissues that are diseased, lose at least, in part, their physiological functions. Instead of standing as a guard, to arrest and destroy micro-organisms, they supply a soil for their propagation, and encourage their entrance into the system.

Removal of diseased tonsillar tissue, that needs removal, should be done early and not postponed. As before stated, let it be known to the patient, that diseased glands in the mouth, need as prompt attention as do tubercular glands, in any part of the system.

It is claimed by investigators, that the chief point of entry to the human body for tubercle bacilli is the faucial gland. Passing from the tonsil, through the lymphatics, they reach the glands of the mediastium.

There are also those who believe in the germ theory for rheumatism, who claim the entrance to the general system of the rheumatic poison, is through diseased tonsils.

When tonsils are diseased, they fail in their proper functions; they interfere in the physiological functions of the oral cavity and the nares; they lower the vitality to the general system, and thus destroy the protection against bacterial invasion. Knowing this, there is no reason why diseased lymphoid tissue should not be removed.

There are many useful instruments in the market, and many good methods for the removal of tonsils. It matters not so much what instruments have been used, or what methods have been employed, if the operation has been done thoroughly, and the desired results have been achieved. Good instruments are necessary, but success depends more upon the operator than upon the instruments.

#### DISCUSSION.

DR. STUCKY, Lexington, Ky.: This subject has been threshed out over and over again; so often that it is almost as much as a man's reputation is worth to say anything about it; so I am glad the pendulum is swinging a little from the one extreme of ultra radical surgery of the nose and the throat to the more conservative. I am convinced that we take out too many tonsils, and sometimes too much of a tonsil. I believe, as the essayist has said, that there is a pathological condition of a part of the tonsil and it is not necessary to remove the whole tonsil. I also believe that the adenoid tissue in the vault of the pharynx is responsible for more of the discomfort than the faucial tonsil, and I question very much the advisability of removing

every enlarged tonsil that we meet. I believe that the faucial tonsils are frequently the gateway where the first warning we have of systematic disturbances is seen, and many cases of tonsillitis are not due to a pathological condition in the tonsil itself, but are simply a local manifestation of a systematic condition. The removal of the smallest quantity of adenoid, these flat adenoids, does more good than the removal of the tonsils.

DR. BALLENGER: Perhaps there is a time to do tonsillotomy, but in my opinion it is more often proper to do tonsillectomy. In other words, it is more often proper to take out the whole tonsil than a piece. I do not wish to go on record as saying that it is never proper to do tonsillotomy. I have seen tonsils partially removed so many times which still continued to be the seat of follicular inflammation that I prefer to remove the follicles entirely. In order to do so, it is practically necessary to remove the entire tonsil, as it is only the basement membrane that forms the bottom of the crypts. The specimen I showed you is simply an ordinary dissection of the tonsil itself in which none of the fibrous tissue, to which the tonsil is attached at its base, has been removed. When at the bottom of the tonsil, the lower portion as the patient sits, there is a great deal of dense fibrous tissue, its removal, I think, is perhaps reprehensible practice. In other words, in making a dissection, try to make a clean dissection, just including the investment membrane of the tonsil.

I have never attempted any operation, in all my experience, as difficult for me to master as the dissection of a tonsil. I was so thoroughly convinced that clean dissection was the proper method that I kept at it until I think I have finally mastered the technique so that I can do it ordinarily without the removal of anything but the tonsillar tissue. I do not have the accidents that may occur if a part of the anterior or posterior pillar is cut away. The ugly scarring of the wound that occurs under such conditions is avoided, and a smooth cicatrix results. The deep fossa that is left immediately after the operation fills in smoothly with granular tissue. There is much less hemorrhage than in the haggling work that I did myself in my early experience. With Kyle's right angle knife, by careful technique, I am able to skim around the edge of the tonsil and back of the tonsil, cutting the fibres down almost to the hilum, and then I introduce the instrument and cut off the base and divide any remaining attachment, making a clean dissection. This tonsil shown was removed in the manner I have described.

DR. KYLE: If I correctly understand the tonsils, they are small embryological structures and should undergo partial atrophy, I think

about the twelfth year. After birth they may, from infection, become enlarged and during the process of enlargement may undergo a slow form of inflammation. As long as this continues, they are evidently a pathological body and such circumstances necessitate complete removal. They may, after having reached their complete development, undergo a slow process of atrophy or sclerosis due to fibrous degeneration, and then remain innocuous, as a small fatty tumor, which may become encysted and never give rise to any trouble. But as long as they have any of that kind of degeneration, and as long as they have developed to any size larger than a pea, they are pathological bodies in the true sense of the word and should be removed. I do not believe that a tonsil has any function. If it has the function of destroying micro-organisms, it is simply accidental, and is due to the fact of the phagocytes being in the tonsil.

DR. HOTZ: I wish to call attention to an article published in the *University of Pennsylvania Bulletin* for October last on the physiology of the tonsil. The author had made a very careful and scientific study, and he made a very conservative estimate of the conditions of the character of the work, with several very interesting suggestions. He suggested that the tonsil had two functions, one was the absorption of solids in a finely comminuted state, and of fluids; and the other was as he supposed a lymphogenic function. He likened the tonsils to a certain extent to the solitary follicles in the intestines; and he called attention to the fact that the adenoid tissue, the lymphoid tissue in the pharynx, begins to undergo development, enlargement if you will, as the thymus gland undergoes atrophy; and he believed it had something to do with the taking up of the function of that organ. How much truth there is in this I do not know; but I think it is very interesting to all who care about the physiology of the tonsil.

DR. PERCY FRIDENBERG, New York: There is very little left to say except that we know very little about the physiology of the tonsil. We are just beginning to learn something of ductless glands, and perhaps in years to come some light will be turned on the tonsil. There is a great difference of opinion as to the role of the tonsil. I do not think we should give the tonsils a bad name in order to operate. They are, after all, something more than lymphatic glands such as the adenoid growths which are more irregularly formed. As to the question of when they should be removed, I think a mistake has been made in relying too much on the appearance. I think the history of the patient and the physiology of the tonsil should be the guide. They should be removed when they have given symptoms of obstruc-

tion, interference with the voice and breathing. One other indication is the repetition of the attacks of tonsillitis itself. That is the most urgent indication for removal. I do not think the measurements should have anything to do with the case, and I think there are certain hypertrophic tonsils which should not be removed.

DR. S. G. MINOR, Detroit: In reference to diseased faucial tonsils the statement that in advocating their removal, we should explain that these tonsils are as apt to undergo tubercular degeneration as enlarged cervical glands, I think is not correct. It is very improper to compare the probabilities of cervical diseased glands becoming tubercular, a very common result, to this probability in diseased tonsils, and to look for the same indications for operative treatment on the ground that they are apt to become tubercular. I do not think it is necessary, as sufficient actual reasons exist for their removal. It is very rare indeed for diseased tonsils, either faucial or lingual, to become tubercular, and very common for the cervical glands to do so.

DR. SPOHN (closing): In reference to the statement made by the last speaker, I did not say the faucial tonsils became tubercular. I never alluded to tuberculosis of the tonsils.

In reference to Dr. Kyle's statement as to atrophy, the faucial tonsils do not atrophy at 12 years. The pharyngeal tonsils atrophy from 12 to 15 and the faucial tonsils from 30 to 45, more frequently from 35 to 40.

In reference to Dr. Ballenger's removal of the tonsil; the specimen tonsil that he here exhibits was not removed *in toto*. That tonsil was removed down to the hilum, but there is a fibrous portion, a base below that. I can not understand why any one should want to remove that fibrous portion. There is no necessity for its removal. It will never inflame. It is only the lymphoid tissue that will ever become inflamed, and that is all that it is necessary to remove.

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## INTRANASAL PRESSURE A CAUSE OF HEADACHES, DIPLOPIA AND OTHER OCULAR DISTURBANCES.

BY KATE WYLIE BALDWIN, M.D., PHILADELPHIA, PA.

Some years ago I was very forcibly impressed by the possible far-reaching reflexes from intranasal obstruction or pressure even, when nasal respiration remained free. The general development may be materially modified,—to such a degree as to cause serious anxiety. Frequently the nose is considered a possible cause, only after all other means of relief have been exhausted. Such desperate cases have formed a very large percentage of those coming under my observation. I long since decided that continuity of tissue; direct connection of nerve and blood supply was not an essential. Some quite insignificant injury to foot or hand may cause a severe headache, even though the nerve and blood supply is quite distinct. The perfect human being is more than an accurately adjusted machine in which the loss or loosing of a small screw may prevent the perfect running of the whole.

The fact that the removal of septal spurs or ridges, polypi, etc., has relieved severe headaches and pathological conditions in other parts of the body led me to investigate other causes of pressure in obstinate headache and eye troubles, cases in which neither spurs, ridges nor deflected septum could be blamed. In such cases my attention was first called to the fact that when the trouble is unilateral, or nearly so, the nasal tissues of the corresponding side are hypersensitive. The most careful introduction of the nasal speculum may be almost intolerable; while its use in the opposite side is not abnormally unpleasant. Thorough investigation usually shows a middle turbinate out of proportion to the space and consequently making pressure either on septum or outer wall. The touching of some especially close point will produce or increase the pain suffered.

When these conditions show at the first examination, I usually make several, having the patient report when free from the discomfort, also when it is severe. If a very careful contraction of all the soft tissues relieves the pain, while a touching of the special pressure points brings it on, I am assured of the connection between pain and pressure. Usually the patient is convinced, even if at first he has been skeptical. A rough examination is never admis-

sible, neither is it necessary, and often would be the cause of failure to relieve, as the cases would not be well chosen, and nothing but disappointment follow. Keeping this constantly in mind, I have never failed to secure partial, if not complete relief, and the patients have been entirely willing to attribute the improved condition to the operation.

Some of our most careful observers say that an unpleasant dryness of throat and nose is prone to follow middle turbinectomy. My cases have not proved this statement true.

The following cases I have selected to report because they yielded to operation after much and long continued treatment had failed to give any relief:

*Case No. 1.* Katie J.—37 years old. Had never breathed through the nose. Always has had severe headaches, frontal and temporal, and a pain at the base of the nose, which seemed connected with that which was the hardest to endure, a “drawing”, “clutching” pain in the occipital region, much increased by the recumbent position. Had glasses, but they did not relieve either the head or eyes. For three years had not been able to work, slept but little and ate less—often taking nothing but tea. For two years the pain had been constant, she being obliged to sit up night and day, either in a chair or with many pillows in bed. In fact she could seldom be induced to go to bed. In September, 1904, she was persuaded to consult Dr. Baldwin, of Newport, R. I., and I saw her the same day. She was ready to consent to anything. “Take my head off. Do any thing that will relieve this pain.”

Examination showed a narrow nose. Pressure at the base increased the pain, especially that in the occipital region. Inferior turbinates in fairly good condition. Both middles tremendously large and very firm. With such a history there was no question as to the advisability of operating. The next day I did a double middle turbinectomy, being able to remove only about three-fourths of the left one. As I was about leaving Newport, it was impossible to do more until this summer.

She stood the operation remarkably well and in less than an hour exclaimed that all the pain in the back of the head was gone. I supposed the anesthetic was the cause but that pain never returned. The next night she was able to go to bed and lie with but two pillows. Now one year from the operation, her general condition is much improved. Still she is not a well woman, except by comparison. She and her family feel that there has been a very great change. In August, the patient suggested that she was able to return to work. In the past year she has really done many things.

It is not my purpose to report any but middle turbinal cases in this paper, but the following is of interest in connection with *Case I*:

A young woman of nineteen was relieved completely of a severe ache in the back of the neck, extending to the lumbar region, by the removal of a large septal spur and pharyngeal tonsil. It is now five years since the operation and there has been no return of the discomfort.

*Case No. II.* Dr. B.—for years had the feeling that the left eye was a lame member, not to be used unless necessary. The recumbent position caused the eye to become congested and muddy looking. About ten years ago a very marked episcleritis developed. Atropine was used continuously for three months. Nasal mucous membrane was very sensitive to cold, which caused pain and increased secretion. Up to eighteen years of age had much dull headache.

Examination showed extreme sensitiveness. The most careful introduction of the speculum gave much discomfort. Several times the patient left the chair. Any nasa' douche was required very warm; if a little cool it caused pain and I was requested to increase the temperature. The left middle turbinate was large, anterior end soft and boggy. Nine years ago this summer I removed about three-fourths of it. Local anesthesia made the operation possible but far from painless.

Since the operation the nose is not abnormally sensitive to examination, the left eye has given no trouble in doing its share of the work and is no longer muddy and congested.

*Case No. III.*—A sturdy-looking German woman of thirty-two. Had severe frontal and temporal headaches for two years, increasing in frequency and severity, also pain in eyes, and obstructed nasal respiration.

Examination showed, inferior turbinates in fairly good condition, middle turbinates large. The septum was slightly deflected to the right, making operation on the right middle difficult; but as the pain commenced and was more severe on that side, this was the turbinate to first remove.

It was one of the most difficult turbinectomies I have ever done, the bleeding being free even from the puncture of the needle in injecting the anesthetic. More than the usual amount of discomfort followed the operation; at least the patient made more than the usual complaint. For a week or ten days she did not admit that the head was any better. In less than three weeks she was free from headache and could use her eyes without discomfort. Six months later there had been no return of pain.

*Case No. IV.*—November, 1904. Dr. T.—From early childhood had severe periodic headaches, giving sensation as of a band around the base of the brain, pains shooting to the circumference as if head would fly in pieces. Extreme prostration, vomiting always severe, and sometimes diarrhoea. Fever always present, at times high, 102-103° F. Paroxysms varied gently as to severity; at times lasting only a few hours, again three or four days. Delirium present, on more than one occasion lasting several days. Post-nasal discharge constant. A profuse serum discharge demanded much attention. Frequent micturition very persistent. No eye trouble. Eight months ago paroxysms began coming at every menstrual period with increasing severity. General health became greatly impaired. Digestion about as usual. Patient ready to cry on the slightest or even no provocation.

There was no sign of polypi by anterior examination, but post-rhinoscopy showed them in both choanae. The inferior turbinates were much congested; the middle turbinates very large and they could not be contracted sufficiently to bring the polypi into view. There was a history of one from each side having been removed within two months. The general condition, the extreme pain and profuse serum discharge made the patient anxious for relief. When I remarked that the removal of the middle turbinates was supposed to cause dryness of throat and nose. The answer was: "By all means, remove them then." As the left was causing more pressure we decided that it should be removed first—and the other if necessary. I repeatedly contracted the right middle turbinate and removed practically all of the left one, and later several good-size polypi. As some were removed, others came into view and were removed with no other anesthetic than adrenalin. The patient was so sensitive to cocaine I could not use it without unpleasant symptoms and with the use of adrenalin there was little pain. All conditions quickly improved and the doctor was able to do a hard winter's work, but had pneumonia in the spring. There has no unpleasant dryness resulted and Doctor T. is ready to have the right middle turbinate removed at any time I think best. I shall keep the case under observation and operate only if symptoms develop.

Report of September 2nd, 1905: "I am happy that I can speak of it as in the past. I hate to think of the 'circus' I was having this time last year. I have had no headache since the operation. Nasal discharge greatly lessened, micturition normal. General health immensely improved."

*Case No. V.* August, 1903. Miss P.—Age, twenty-seven, seamstress. Had severe headaches and trouble with eyes for two years. Pain constant in the ball of left eye and at inner angle, extending down the nose, at times also in the right eye. Severe frontal headaches, extending to left temple and mastoid region, always worse at the menstrual period, increased by use of eyes. Much dizziness.

In 1901 the following glasses were prescribed for constant use:

O. D.  $+1.25 = +0.25$  cy. ax.  $180^{\circ}$

O. S.  $+3.25$ .

In the two years they had made no change in the conditions, except in the dizziness which improved very much. General health always good until these head and eye symptoms appeared. When she came under my observation in 1903 she was much below par in every way, and this in spite of constant medical care. All symptoms were increasing and for a year she had not been able to use the eyes for anything without aggravating the pain in both head and eyes, especially on left side.

I had examined her nose in 1902 but did not feel that operation was justifiable. In August, 1903, her physician requested that I again see her. Examination showed extreme sensitiveness of nasal mucous membrane, especially in the left side. Middle turbinates very large; left causing much pressure. Examination increased the pain. Careful contraction of all the tissues gave some relief. Repeated examination gave the same result and operation was decided upon. The left middle turbinate was removed and further operation was not indicated as the headaches promptly disappeared and the eyes gradually improved as did the general health, the patient taking up her household duties, reading and sewing included.

In 1904 she reported as all right and doing just about as she pleased. In August, 1905, the young woman was able to tell me that since March she had been sewing in the shop, working as many hours as anyone. She was able to read and sew evenings if she wished, with no discomfort, except for an occasional very slight headache at the onset of her period. No unpleasant dryness of throat has developed.

*Case No. VI.*—In the fall of 1903, Dr. F.—came to the Polyclinic Hospital, Philadelphia, to do special work in eye, ear, nose and throat. After seeing several cases in which middle turbinectomy cured severe pain; one of his associates suggested that probably he had a large middle turbinate and that it was the cause of the pain he suffered. He was willing but not anxious to be used for clinic demonstration. Later he came to the office and I made an examina-

tion, which convinced him that in all reason the nasal condition had something to do with the pain and he decided to take the chances of an operation. The history was of a rather marked exophoria which caused severe pain in the eye but never real diplopia. When eighteen years old he began having every day (from about ten to eleven a. m.) severe pain in the left temple extending into the left eye and the two left upper bicuspid teeth. The teeth were both sound, but extracted with no effect on the pain. The pain was always attended by a feeling of fullness in the left side of nose with a constant desire to clear by blowing. In about an hour the pain would get better and the nose from being dry would become a little moist. The appearance of the moisture always meant an end of the neuralgia for the time. There was never any real pus in the discharge, which was a clear fluid very small in quantity. The fullness in the nose disappeared with the appearance of the discharge and soon the pain would leave. The coal-tar products relieved the pain, but it would usually get well of itself in from one to two hours. Quinine, tonics and arsenic did no good. He was unable to work while the pain lasted and at times it became so severe that chloroform was resorted to. Exposure to drafts brought it on at any time. Damp weather usually made it worse. In the dry fall, he was often free from pain for months. It was not a headache; it was a pain in the temple, cheek, eye and teeth. Occasionally it appeared on both sides, but usually on the left only.

December 29th, 1903, I did a left middle turbinectomy. Adrenalin did not blanch the tissues and cocaine had no more effect on the pain than so much water. After using all I considered safe we resorted to chloroform anesthesia. The bleeding was unusually free. The middle portion of the nose was very narrow so that work on the middle turbinate was difficult. This case with some others about the same time made me feel that I must find some instrument not then known to me and I had made a small saw which has served me well in many cases, when the space was too narrow for scissors or forceps. In fact I now seldom use the scissors unless in a very roomy nose.

The doctor was much relieved. The last of January, 1904, he went abroad for six months of study. He had no pain except while in England where it rained all the time. The report from him in August last is: "Your turbinectomy did me much good. I am now practically entirely free from the pain."

*Case No. VII.* Miss B——. Twenty-three years old was referred by Dr. Getty, with the history of severe left-temporal and

frontal head-aches with discomfort in left ear; accompanied by marked diplopia, the left eye only being involved. The statement was that Dr. Getty and the general practitioner had exhausted their resources with little if any improvement. The patient was obliged to give up her work as a stenographer and in a general way was fast losing ground in consequence of the pain and worry.

There existed hypersensitive nasal mucous membrane especially of left side, and a very large left middle turbinate, examination of which increased the pain and caused much suffering for the remainder of the day. Teeth and throat in fairly good condition except for a moderately large pharyngeal tonsil.

The date for operation was arranged when some near relative in the profession desired that she see Dr. Samuel D. Risley, who was a personal friend in whose professional judgment he had great faith. Dr. Risley saw Miss B—— and it was decided that the salicylates should be pressed for at least two weeks, using larger doses than had previously been given. Dr. R. said by all means have the operation if Dr. Baldwin thought it necessary, but that he did not see how it could possibly benefit the eye. For over two weeks twenty or more grains of salicylates were taken three times a day, without the slightest benefit. It was then decided to go on with the operation. A left middle turbinectomy was done February 21st, 1904. The patient was pretty well "knocked out" by the operation but was able to come to the office, a distance of several miles, on the third day. At the time of operation the exophoria was  $24^{\circ}$  at 16.4 feet; five days after operation only  $12^{\circ}$ .

On April 30th the pharyngeal tonsil was removed. There was a gradual improvement in the eye, until finally it overcame  $10^{\circ}$  at 16.4 feet with vision in either eye 16/131. There was very little headache from the time of the first operation. When I left the city the first of July she was so much improved that her friends considered it quite wonderful and thought the case should be reported so he that runs may read.

Miss B—— reported the 5th of October, having been quite well all summer. Had been back at her work and did well until one day she was asked to do some unusual work in a very short time. She accomplished the work but it proved a too great nervous strain and her general condition suffered much and the eye to some extent. I found a postoperative synechia and a tiny bit of organized granulation tissue, removal of which was beneficial, and on November 15th she was able to overcome  $10^{\circ}$  at 16.4 feet with vision in either eye, with glasses, 16/131.

The following report came from Miss B—— August 21st, 1905:  
 "I now see very clearly. Can read an hour at a time without any bad effects. My nose and throat give me no trouble and I can conscientiously say that I am a well girl."

The following is Dr. Getty's full report of the eye conditions:

August 29, 1903. Has had pain over left eye for past week. Sees double when looking to the left.

Wearing O. D.—0.25 = + 1. cy. ax.  $75^{\circ}$  = 16/131.2.

O. S.—0.50 = + 1.25 cy. ax.  $100^{\circ}$  = 16/131.2.

Orthophoria with correction.

Ophthalmic examination:

Media clear. Discs round. Fundus normal. Both eyes.

Cum Homatropine.

O. D. 16/393—0.25 = + 1.25 cy. ax.  $85^{\circ}$  = 16/131

O. S. 16/74 —0.25 = 1.50 cy. ax.  $100^{\circ}$  = 16/131

Rx + 0.25 off Orthophoria

December 26, '03. Exophoria  $15^{\circ}$  at 16.4 ft.

Images on a level.

January 27, '04. Not able to rotate left eye beyond median line. Other movements correspond to right eye. Exophoria  $24^{\circ}$  at 16.4 ft.

February 26, '04. Exophoria  $12^{\circ}$  at 16.4 ft.

April 20, '04. Orthophoria at 16.4 ft. Patient still sees moving objects double, as trolley cars or people at a distance.

September 3, '04. Patient complains of not seeing clearly and at 3 ft. sees double images on a level and both distinct.

With comidation,

O. S. Vision 16/131.

O. D. Vision 16/164. Exorophoria  $3^{\circ}$  at 16.4 ft.

September 2, '04. Exophoria  $10^{\circ}$  at 16.4 ft. with glasses. Has a swelling of upper lid of left eye, also pain in the eye. The ophthalmoscope showed no change in the eye ground.

November 15, '04. Overcame  $10^{\circ}$  at 16.4 feet.

Vision in either eye with glasses 16/131.

#### DISCUSSION.

DR. IGLAUER, Cincinnati, Ohio: We are greatly indebted to Dr. Baldwin for calling our attention to this important subject. I think these pains in the head are more in the nature of a neuralgia than a headache, and we, as specialists, are fully aware how frequently they occur. I believe, however, that the general practitioner is not cognizant of this fact and he is prone to treat these cases as headache



of an unknown origin, and delays too long in sending them to the specialist. You will notice in this list the number of patients who were physicians. It often takes them a long time to discover what is the matter. It never seems to occur to them that a headache may originate in the nose. In my experience, a headache which arises from an enlarged middle turbinate is usually a frontal headache. I believe Dr. Baldwin noticed it more in the vertex or occiput; but the pain is usually above the eyes. It is important to rule out a simple neuralgia of the trigeminal nerve, and you can usually do that by pressing over the exit of the nerve over the orbit, and over the infra-orbital foramen. The condition in the nose is usually typical. We find the anterior end of the middle turbinal in contact with the septum; and I have often noticed the hyperaesthesia mentioned in the paper. Another sign is that, when you put in the probe between the turbinal and the septum, there is a certain resiliency as if the turbinal were acting as a spring. It will jump back as it were, as soon as you remove the probe. Dryness in the throat was mentioned as a possible sequel to this operation, but it was not considered prone to occur. It seems to me that the removal of the inferior turbinate is what causes a dry throat and not the middle turbinate, because the passages in the attic of the nose are narrow, and therefore even after the turbinate is out there is sufficient surface to moisten the air. These cases are prone to neurasthenia. The patients become very nervous, and there is a vicious circle established. One case of recurrence was reported. I had one case, a physician who had been operated upon several years ago by the late Dr. Thorner. After several years these headaches recurred and the character of the pain was immediately recognized. I found the middle turbinate had undergone enlargement for a second time. I removed the enlarged portion, and the headaches again subsided. These enlarged turbinates are often cystic. The diplopia has not come under my observation; but I should like to call attention to an article in the last number of the *Journal of the American Medical Association*, by Dr. Posey. He points out that this diplopia may not be manifest, may only occur in the peripheral field of vision and may only be discovered upon careful examination of the eye. He also discusses the etiology of this diplopia. It may, *first*, be mechanical. *Second*, it may be due to a contiguity of the diseased process; that is, the inflammation may extend from the ethmoid cells into the belly of the muscles. In this case rotation of the eyeball will produce pain in the muscle. *Third*, the nerve supplying the muscle may be affected and in that way produce the diplopia.

DR. MURPHY, Cincinnati, Ohio: I have not had any complaints of dryness following this operation. In fact, in most cases there is excessive secretion and the patient is much relieved when this is stopped and some drying up of the nose occurs. In reference to the subject of removing the middle turbinate we all have our different methods. I usually get better results by means of the middle turbinate scissors devised by Dr. Holmes. The saw that was shown I used twelve years ago, invented at that time by Dr. Vail. He has the identical saw, and in many cases it acts very nicely where the parts are so narrow that the scissors can with difficulty be introduced.

DR. STUCKY, Lexington: I believe the more we study the middle turbinate the less use we will have for the cautery and treatment of the inferior turbinate. I know of no operation that has afforded as much complete relief in my work as removal of a diseased middle turbinate. The discomfort and pain in a majority of instances that I have recorded has been in the back of the head except in acute cases and there we have the frontal headache. I do not believe the pain is due to a diseased turbinate, that is, the turbinate being diseased itself, as much as to the pressure caused by it. The turbinate is simply an off-shoot of the ethmoid, and whenever it touches the lateral wall, or blocks up the middle meatus at all, then we are going to have trouble. We have trouble not only with the ethmoid, but with the frontal. We may have violent and persistent pain as the result of nerve pressure, but I believe it is more frequently the damming up of the natural secretions of the accessory sinuses. I never had any dryness of the throat following its removal. Nothing gives my patients as much relief as its removal when abnormal. I never have seen anything but good results, and I have practically used but the one method, the scissors and the snare.

DR. BECK, Chicago, Ill.: I rise to endorse Dr. Stucky's remarks, and I supplement them by the fact that the middle turbinate body I find is not diseased. I speak of sections made of the middle turbinate body that I removed for the same purposes, and my diagnosis in many of these cases of headaches, frontal or occipital is sinusitis. I have used the Holmes scissors on the turbinate body, or the saw. It depends on how the nose is built. If it is narrow a saw such as Dr. Baldwin has shown, which I think is better than Vail's, because it is smaller, is more suitable than scissors. The sinuses, according to the works of many who have made post-mortem examinations, show disease, not a purulent sinusitis, but muco-purulent. And therein lies the secret of these headaches and eye symptoms. I have no doubt there may be an affection of the eye muscle or the nerve

or any part adjacent to the sinuses, or the middle turbinate body may become affected.

DR. ANDREWS, Chicago, Ill.: I fully agree with Dr. Baldwin and with what has been said in this discussion, but I would also add a symptom which I have frequently heard mentioned, the balloon feeling in the head. I do not know what the balloon sensation is. I have no means of knowing. But three patients, one a physician, have mentioned the sensation within the past month. This sensation was relieved by the removal of intranasal pressure; in some instances the removal of the middle turbinate, in others the removal of ridges or spurs upon the septum.

DR. SPOHN, Elkhart, Ind.: There are some noses, those very narrow noses, with no particularly enlarged turbinates, that have intense headaches. I have seen a number of cases the past six months, where the family physician had prescribed tonics *et cetera* with no results, that were relieved by local treatment of the septum.

The pressure was not so great, but there was an extreme sensitive condition of one side of the nose. My diagnosis was periostitis of the vomer. Repeated applications of cocain and adrenalin solution followed with iodine, gave relief of the headaches.

DR. BALLENGER: I wish to corroborate what Dr. Baldwin has so clearly set forth, the value of removing intranasal pressure. Recently I operated upon a patient for this purpose. He was troubled with headaches and had been unable to get relief by any prescription for glasses, several of which had been given him. He came to me on his own diagnosis of a deflected septum. He said he thought he needed a submucous operation. His septum had a large ridge on the right side and a deflection toward the middle turbinate on the left. Instead of removing the turbinates, I performed the submucous operation. This was some two months ago, and up to this time he has not had a recurrence of his headaches. I do not want to be understood as advocating a submucous operation instead of a turbinectomy. I cite the case as one illustrating the result of relieving intranasal pressure.

DR. BALDWIN (closing): The first gentleman spoke of the frontal headache as being more severe than the temporal. In many cases a temporal headache is really more severe than the frontal. It removes it a little further from the middle turbinate, as does the occipital headache. In temporal headache the pressure on the outer wall is often more than on the septum. Just here I would like to speak on that point. You will sometimes find the septum side perfectly free and the pressure entirely on the outer wall. I operated on a case of

that kind six weeks ago where I declined to operate five years before, and the case had been treated ever since by the general practitioner. There was plenty of room on the septum side; a firm, very large flat turbinate had adapted itself to the outer wall till there was practically no space except just at the base. In that case there was stiffness of the jaw as well as the temporal headache. The stiffness of the jaw disappeared as did the headache. Holmes' scissors, it would have been impossible to use in the majority of the cases I have reported. The space in front being too narrow to permit of seeing when using the scissors. I have used them in other cases. I did not know Dr. Vail had such a saw as this. Mechanical pressure was mentioned. There is something in it. The reflexes are even greater than in other parts of the body. One speaker referred to the reflexes in reference to the bladder. I have had several cases where atrophy or nasal pressure has caused very unpleasant bladder symptoms which were relieved by proper care of the nose. The balloon feeling may be the same as the feeling of bursting. I do not for a minute wish to be understood as believing that middle turbinectomy will remove all headaches. I have declined to operate on many cases referred to me for headaches; and I now think I have declined to operate on some which with my present experience might be relieved. In regard to the septum, I have had many cases with the septal condition Dr. Ballenger spoke of. I did not report them in this paper simply because I wished to confine it to the middle turbinates. As to the use of cocaine you will find a solution of adrenalin will almost always be sufficient for diagnostic purposes, and less dangerous to the patient.

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## THE TREATMENT OF ATROPHIC RHINITIS BY MEANS OF AN ORO-NASAL CANULA.

BY SAMUEL IGLAUER, B. S., M.D., CINCINNATI, OHIO.

The problems of atrophic rhinitis remain unsolved. Many theories are advanced as to its etiology and pathology. Even as to its diagnosis we are not always certain; its prognosis is bad, and its treatment purely symptomatic. Sclerosis of the middle-ear has been termed "das Schmerzenskind der Otologie," and with equal justice, atrophic rhinitis may be called "das Schmerzenskind der Rhinologie."

In recent years there have been some very interesting researches concerning the nature of this disease; and in this paper, it shall be my purpose to briefly review some of the later literature on this subject. The theories concerning its origin may be divided into first, the infective or bacterial; second, the theory of secondary involvement from sinus disease; third, that it is a trophoneurotic or nutritional disease.

By some, the *Bacillus mucosus* of Abel and Löwenberg (1) is regarded as the exciting cause. This micro-organism is closely related to Friedlander's bacillus, and is usually found in great abundance in the nasal secretions of those affected with this disease. The mere presence of the micro-organism, however, does not necessarily mean that it is causally related to the disease. The researches of Döbeli (2), for example, show that bacteria do not appear in the secretions until several hours after the diseased mucosa has been cleansed.

Cholewa and Cordes (3) were unable to find the bacillus within the tissues of their carefully prepared sections; in fact, it did not even invade the epithelium. They point out that a micro-organism which merely rests upon a diseased tissue can scarcely be regarded as an excitant of disease; although they admit that its presence under the crusts must aggravate the disease process. So constant is its presence that Cholewa in doubtful cases, regards its determination of great diagnostic value. The *Bacillus mucosus* then is rather constantly present in atrophic rhinitis, and is associated with the production of the fetor, and by its presence tends to aggravate the disease process, but it cannot be regarded as its cause.

Bosworth (4) insists that atrophic rhinitis is a sequel to a purulent rhinitis of childhood, but names no specific organism. The incidence of atrophic rhinitis (5), as shown by the examination of school children, would not tend to bear out his hypothesis.

Grünwald (6) claims that nearly all cases of atrophic rhinitis are attributable to secondary manifestations of sinus disease, in fact, he would trace all such cases to a focal suppuration, and claims that after the original nidus has been cured the picture of atrophy will disappear. In many instances, no doubt, this is the case, but certain facts prevent a general application of this rule.

Freudenthal (7) for example, cured a case of antrum disease associated with atrophic rhinitis without, thereby, in the least affecting the atrophic process. Minder (8) presents this same argument. In Case I, of this paper, the patient presented symptoms of acute frontal sinusitis and this subsequently subsided. Finally the recent work of Döbeli (9) is conclusive. He set himself the ambrosial task of studying his cases of atrophic rhinitis hour by hour. After thoroughly cleansing the nose, he found that the secretion began to appear at certain minute points distributed on the turbinated bodies, as well as on the septum, and often in positions which precluded its origin from the sinuses. Hour by hour he watched these spots grow and finally coalesce and form the characteristic crusts. His studies further show that former ideas concerning the nature of the secretion were entirely erroneous, since he found it to be made up chiefly of leucocytes which come to the surface by diapedesis from the underlying mucosa. During the later hours epithelial cells and bacteria appeared, and with the latter also the fetor. Döbeli regards the mucous membrane in this disease as abnormally permeable for leucocytes.

A study of this subject is in no way complete without considering the work of Cordes and Cholewa (10). Briefly stated, they found the chief, and often the primary changes, not in the mucous membrane, but in the underlying bone. The latter shows a process of resorption and softening, not of an inflammatory nature, and regarded by those authors as a form of osteo-malacia. Their drawings really show two distinct disease processes, first an osteo-malacia; and secondly, a chronic inflammation of the mucous membrane, associated with changes in the epithelium and the glands. Their theory revives the theory of a purely trophic disease in a new and concrete form.

If the riddle of the cause of atrophic rhinitis remains unsolved, its treatment also is far from satisfactory. In general it may be stated that the efficiency of therapy is in inverse ratio to the number of remedies recommended, and this is undoubtedly true of atrophic rhinitis, for which a host of measures has been tried. These vary from the use of alkaline cleansing agents and local irritants, to the injection of diphtheria antitoxin, or the breaking of the diseased turbinate bone. The cautery and electrolysis have had their adherents and denounciators. Paraffin has been injected under the mucosa with the idea of closing the wide lumen of the nose. Gottstein's tamponade frequently repeated has proven advantageous. One author (11) recommends menthol, formaldehyde, ichthyol and gomenal, but speaks of "the desperate straits befallen the therapeutics of this obstinate condition." All the text books give long lists of remedies.

The accepted treatment is purely symptomatic and aims at two goals, namely: first, to cleanse the nose of the tenacious, foul crusts and to keep it clean; and second, to stimulate the diseased tissue and, if possible, to check the course of the disease. In their last analysis all the effective methods come under these two heads.

Sometime ago it occurred to me that the defective secretion in atrophic rhinitis might, in some way, be corrected by introducing a flow of saliva into the nose, and that, further, this saliva might have a therapeutic effect in modifying the atrophic process. It appeared feasible to constantly cleanse the nose and to supply it with moisture by establishing a small fistulous tract (anastomosis) between the oral and the nasal cavities, in other words, by producing a form of artificial perforated palate for a therapeutic effect. Into this perforation a small permanent tube might be fitted, and through it the patient could, at frequent intervals, force saliva into the nose, and thus cleanse, moisten, and stimulate the interior of the nose. This, too, would prevent the compressing effect of the dry crust which Grünwald (op. cit.) has compared to the action of collodium. The presence of moisture in the nose would also tend to prevent complications of pharyngitis and laryngitis sicca.

I further believed that the saliva being a secretion and foreign to the parts, would perhaps exert a stimulating or irritating effect upon the diseased mucosa and would thus reproduce one of our therapeutic endeavors. Reasoning by analogy, and in support of this hypothesis, it may be stated that a physiological secretion will generally irritate a surface unaccustomed to its presence; for ex-

ample, the gastric juice irritates the skin after the gastrostomy, similarly the bile from a cholecystostomy. In salivary fistulae, the skin becomes eczematous from the constant irritation (12).

According to the statement of Kyle (13), the salivary and nasal secretions are chemically almost identical. Still the saliva contains ferments and bacteria not found in the nose and might reasonably be expected to act as a mild irritant. A further possibility was that the flora of the mouth differing from that of the nose might crowd out any specific bacteria of ozena.

Certain additional practical considerations also favored treatment by this method. The quantity (14) of saliva, 1 to 2000 C. C. in twenty-four hours, would certainly suffice to keep the nasal mucosa bathed in fluid. A further fact of importance is that while ozena often effects the pharynx and larynx, it is never known to invade the mouth, thus showing some specific resistance either in the buccal mucosa or in the saliva itself. Finally, it was apparent that the patient could conveniently use irrigations of water from the mouth through the tube, provided the salivary secretion proved insufficient.

Accordingly, I have devised the following operation for the introduction of a permanent canula between the mouth and nose. The floor of the nose and the roof of the mouth are cocainized and adrenalized; cocaine being then injected into the periosteum of the roof of the mouth by means of a hypodermic needle bent at an angle. A point is selected in the hard palate where it shelves off and becomes horizontal, and about one C. M. from the median raphe. Here a crucial incision is made with a curved, pointed bistoury. With a sharp periosteotome the periosteum is pushed back, exposing the bone. The patient is now instructed to open the mouth as wide as possible. With a guarded bone drill  $3/16$  inch (5 m. m.) in diameter an opening is bored through the hard palate into the nose. Care must be taken not to strip up the mucosa on the floor of the nose. This can be avoided by nicking the mucosa with the curved bistoury introduced through the trephine opening. This operation requires but a few minutes.

After treatment.—The artificial opening is now closed by introducing a flanged rubber plug which fits snugly against the roof of the mouth. The best for this purpose are those used for the repair of bicycle tires. These may be perforated and saliva can be forced through from the beginning of the treatment. The after treatment continues with daily removal of the tube until the oral and nasal mucosae have united. Granulations must be kept down



with nitrate of silver and antiseptic mouth wash. This after treatment is very tedious, and trying both to the patient and surgeon. In Case II it required four and one-half months, while in Case III with better technique, it took but seven weeks.

As soon as the edges of the bone have healed the permanent tube, which I have termed the oro-nasal canula, is introduced. This canula consists of a German silver tube one inch long and  $\frac{1}{16}$  of an inch outside diameter. About the oral extremity of the canula is a hard rubber collar provided with a flange  $\frac{1}{4}$  inch diameter, which may be moulded by a dentist to fit the opening of the roof of the mouth. The tube, when in place, fits very much like a hollow nail driven into the hard palate. The nasal extremity of the tube should extend to the level of the lower border of the

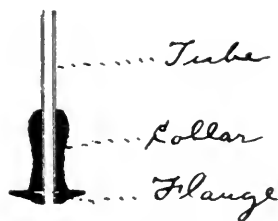


Fig. 1. Oro-Nasal Canula. Sectional View. Actual Size.

middle turbinate body. The canula is self-retaining, and may be removed by the surgeon (or patient) and cleansed, if necessary.

Owing to the fact that ozena occurs in persons with wide nasal cavities, the so-called chamae-prosopia (15), there is usually ample room for the canula within the nose. With the canula in place, the patient can readily force saliva into the nose, using his tongue as a force pump. The saliva may be seen to enter the nose, and forming bubbles spreads out along the lower border of the middle turbinate and along the inferior turbinate and septum. The course of its flow may be easily studied by putting methylene blue into the mouth of the patient.

In the usual course of atrophic rhinitis the inferior turbinate is involved sooner and to a much more marked extent than the middle turbinate (15), so that the saliva reaches those portions of the nose most affected. In addition to constantly bathing the nose with

saliva, the patient can readily force water from the mouth into the nose. By closing the nostril on the operated side and holding the head forward, the water will run through the choana and out on the other side. The lumen is kept clean with a wire bristle. By placing the tongue over the orifice of the tube, the patient can prevent fluid nourishment from entering the nose. There is no interference with phonation.

I have three cases to report, in which I have performed this operation.

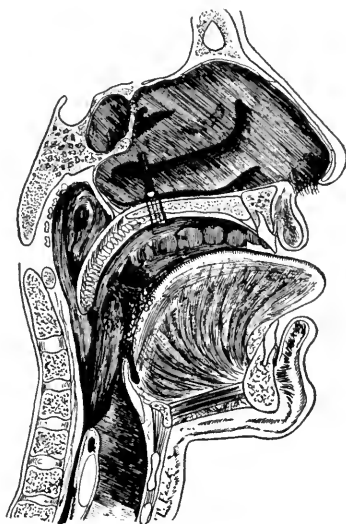


Fig. 2. Sectional View, showing the Oro-Nasal Canula in Position.

CASE I.—Mr. B. V., printer, age 27. Consulted me in July, 1904, complaining of pain over the left eye.

*Family History.*—One brother has atrophic rhinitis (as determined by me in a subsequent examination).

*Personal History.*—This patient had typhoid during infancy. Patient has had crust formation in his nose for an indefinite period past. He would force water up his nose to clear it of the crusts. The patient would occasionally grow hoarse at night. Onset of present trouble began about a week ago with discharge from both nostrils. The pain over the eye was worse in the morning; *status presens*.

*Examination.*—Temperature normal. Marked tenderness over the left middle frontal sinus. Hypertrophy of the anterior of the left middle turbinate with pus at this point. Atrophy of both inferior turbinates to a marked degree. Pharynx visible through the nose on the left, but not on the right, owing to slight deviation of septum. Pharynx dry and glazed. Scarcely any fetor.

*Diagnosis.*—Acute frontal sinusitis; and atrophic rhinitis.

*Treatment.*—Sinusitis resolved under local treatment in a short time. Operation for introduction of oro-nasal canula was performed August, 1904, an opening was made through the roof of the mouth and the opening plugged with cotton. The tube inserted after one week, but I removed it September 12, 1904, as the edges had not healed.

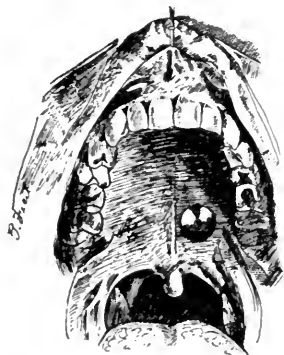


Fig. 3. View of Roof of Mouth, showing Oral Extremity of the Canula fitting against the hard palate.

I treated the granulations with trichloracetic and silver nitrate.

October 4, 1904, the tube was reinserted, although the edges were not healed.

November 12, 1904, the tube was reinserted.

December 3, 1904. The patient now wears the tube with much comfort, forces saliva through freely, and notices fewer crusts in the nose and less dryness in the throat. Some (objective) faint odor in secretion. Crusts not so hard and come out easily when the patient blows his nose (formerly had to blow very hard); crusts not so large and numerous (formerly they were as large as his thumb). Patient occasionally washes out his nose with water from his mouth. Left side free from crusts except about the

tube; dry crusts on the right side. (This was noted after the patient had refrained from washing out his nose for one week.)

May 13, 1905. Reinserted tube after having removed it for about three weeks.

June 3, 1905. Tube now in place for three weeks past. No soreness of mouth; mucous membrane on the left side appears healthier than on the right side.

September 12, 1905. Patient returns with tube in place; tube does not irritate. Reports hardly any crusts on the left side; right side is dry, with crusts more abundant and more tenacious. Washes out nose once every morning with water forced through the mouth. Can wash out the right side by throwing his head backward and then towards the right. Throat is now freer from crusts and more moist than it was before the tube was inserted.

NOTE.—This patient has now worn the tube practically continuously since May 13, 1905, *i. e.*, for four months, and for a period of ten months, barring an interval of three weeks. He has felt so comfortable that he has not found it necessary to consult me for the past three months.

CASE II.—Mr. C. B. K., piano tuner, age 25; consulted me, April 14, 1903, complaining of bloody crusts in nose and noises in left ear.

*Family History.*—One sister has catarrh; she loses sense of smell occasionally, but has no crusts. Four boys and one girl. Sister is the oldest; patient is the youngest. Next brother would get "running spells," would run from one half to one hour without realizing what he was doing, but is now well.

*Personal History.*—Always well until six years ago, when he has epilepsy. Admits gonorrhoea, and denies syphilis.

*Present Illness.*—Trouble in nose began about six or seven years ago with clogging up with crusts. Couldn't breathe through the nose, and would remove crusts by running the little finger into the nose; could run finger into opposite side (through perforated septum). Nose would bleed profusely thereafter; crusts would form again before morning, *i. e.*, it would clog up again before morning. Throat would become parched from breathing through mouth, especially mornings. Would lose sense of smell during winter months.

*Diagnosis.*—Tubal catarrh (left); atrophy of both inferior turbinated bodies. Hypertrophy of the right middle turbinate; perforated septum (syphilis?) No fetor.

*Treatment.*—Oil atomizer; local application of iodine, and the use of the nose cup with saline solution, which would clear the head, but only for a few hours. Patient would use cup two or three times a day. This treatment was continued for about a year, when patient returned complaining of not being able to breathe freely through the nose. Enlarged middle turbinate was removed July 1st, 1904. This operation gave considerable relief. Patient also received antisyphilitic and antiepileptic treatment.

Operation for insertion of oro-nasal canula was performed February 18, 1905. This case required prolonged after-treatment until the artificial opening in the hard palate had healed. Patient suffered from two epileptic seizures, caused by manipulations in the nose and once also had the packing drop into the larynx while asleep, but coughed it up. The permanent canula was inserted June 17, 1905. Patient had first found the tube somewhat annoying, owing to the passage of air through the same while talking and smoking. There was also some soreness under the plate.

As a result of this treatment he reports that the crusts can be much more readily removed by keeping them moist with saliva. He very seldom finds it necessary to use saline solutions as an adjunct to the canula. He uses the nasal irrigation but once a day, and finds that crusts do not come out in lumps as formerly, and that the quantity of crusts is about half what it formerly was.

July 15, 1905. Patient reports that he has used the nasal douche but twice during the past week, and has found the use of the oro-nasal canula much more convenient. He washes out the nose two or three times a day by forcing water from the mouth through the canula and into the nose. (I always have this tube with me, he says). Owing to the perforation in the septum he is able to wash out both sides at once. He forces saliva through quite frequently during the day. The mouth is not sore, there is no odor, there is slight annoyance while drinking, but not enough to speak of.

July 22, 1905. The tube was removed owing to slight soreness in the mouth. Some granulations had formed and these were treated with nitrate of silver, and the tube was re-inserted.

July 29, 1905. Patient reports no further trouble since the tube has been reinserted.

CASE III.—William R., age 13 1/2 years, school boy. Complained of lumps in nose (crusts); blowing them out caused ear-ache.

*Family History.*—Negative.

*Personal History.*—Measles, whooping cough; no diphtheria, otherwise well. Onset of present trouble began three or more years ago. Boys around him complained of odor; teacher gave him a separate seat in school. Big crusts in nose; would have to blow “insides out” to get them out, and this caused earache; tried tablets and atomizer for two years; then salt water, and carbolic spray. Nothing availed. Went to Ohio Medical College clinic, June 28, 1905, and was kindly referred to me by Drs. Mithoefer and Hinnen. Inspection showed numerous thick, dry crusts, and foul odor in both nostrils. After removing crusts I found marked atrophy of inferior turbinated bodies. Pharynx was visible through the nose. Partial atrophy of both middle turbinates, especially in posterior portions. Drums opaque, slightly retracted.

*Diagnosis:* Atrophic Rhinitis with ozena.

Operation, July 10, 1905. Cocaine and adrenalin anesthesia. Bone drill (hand) left side; rubber canula.

July 15. Numerous foul smelling crusts; both sides, but little reaction locally.

July 18. Slight swelling about opening; somewhat tender. Rubber plug.

July 25. Opening less tender.

July 30.—Beginning to heal; daily removal of plug by patient. Nitrate of silver locally.

August 2. Ditto.

August 3. Tube loose, owing to large opening. Gauze packing.

August 29. The edges of the opening have now healed, and the permanent canula was introduced.

September 6. Patient wears the tube with comfort. He has a scant flow of saliva and therefore washes out the nose through the canula at frequent intervals. By closing the nostril on the operated side and holding his head forward he can force water through the canula into the nose through the choanae and out of the opposite side. He succeeds in keeping the operated side clean, but crusts are still present in the unoperated side. The fetor is now much diminished.

September 13. Patient now has a freer flow of saliva which he forces into the nose every hour or so. Crusts are now much smaller than before operation. The left side very seldom has large crusts. He has been forcing saliva all morning. Inspection shows a large crust about the tube and partly covering the lower turbinate

on the operated side, otherwise the left side is moist and clean. On the unoperated side there are large, dry crusts which are difficult to remove with a probe. There is a slight fetor still present.

*Conclusions.*—The analysis of these cases shows that all three wear the canula without any discomfort. Case II, for example, has not had the tube disturbed for the past four months. They all find it a convenient method of moistening and cleansing the nose. Case I relies chiefly on salivation; Case II on salivation and irrigation; while Case III with scant salivary flow relies chiefly upon irrigation. All three state that they have fewer crusts than heretofore and that these are much less tenacious. Cases I and II have less dryness in the throat than formerly. The sense of smell is more acute in case II than before operation.

Objectively, I find the mucosa on the tube side moist, and the secretion when present is usually semi-fluid, and not tenacious; on the other side the crusts are thicker, drier and more adherent. The mucosa on the tube side has a healthier, smoother appearance than that of the unoperated side. I can, as yet, make out no regeneration of the mucous membrane in any case except Case I, where the flange of the tube has rubbed the inferior turbinate. As regards the ozena, Cases I and II were practically without this symptom from the start, while in Case III there was very marked ozena prior to operation, and is now comparatively free from this sign.

The results in these three cases have certainly been satisfactory and warrant a further trial of this method. In the future, it will be necessary to elaborate the method and either to introduce a canula into both nasal fossae, or to devise a Y-tube which can be introduced into both sides by perforating the septum.

The results in these cases agree closely with those observed by FitzGerald (16), who has his patients moisten the crusts by means of pledgets of cotton saturated with saliva, he says: "We have no place in nasal treatment for the spray or douche, not even in the most exaggerated cases of atrophic rhinitis, or when complicated with ozena. I see these patients three or four times a week, removing the crusts with forceps after moistening them with a wire cotton-wound applicator saturated with the saliva of the patient. The patient must be instructed in the use of the applicator and use it moist at least three times daily. He should also exercise his nostrils frequently. Patients who follow this method carefully, seldom have even minute crusts or any fetor after the third week. It is usually necessary to pursue self-treatment for an indefinite

period, but patients do not object to this, finding it much more simple, agreeable and efficacious than other methods."

Before concluding this paper I wish to express my appreciation of the kind assistance and valuable suggestions of Dr. B. J. Wolff, who constructed some of the canula for me.

Considering the fact that the pathology of this disease is unsettled, that the accepted therapy is a failure, Bosworth (18) for example, has never seen but one cure in all his experience, I feel justified in bringing forward this method which promises to alleviate and perhaps cure this malady, which hitherto has baffled the efforts of the rhinologists. This paper is presented with the hope that some of my colleagues here present will try this method.

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#### DISCUSSION.

DR. KYLE, Indianapolis, Ind.: I certainly want to congratulate Dr. Iglauer on his unique operation. I think it one well worthy of our trial. The discrepancy in regard to the etiology and pathology of the disease was mentioned. If we could only understand the pathology of the disease we might advocate some accurate treatment, but unfortunately, up to the present time as I said before, we have no definite knowledge in regard to the pathological condition. To me it always appeared as a trophic neurosis and that the theory of Cordes was nearly correct in that we have an increase of osteoclasts with atrophy of bone, and also that the ozena or foul odor was more especially due to the want of some chemical antitoxine



that should be in the system, and if we could find an antitoxin we might at least relieve the odor. We must not forget the fact that many of these cases of atrophic degeneration are complicated with syphilis, particularly those in which we have had a destruction of the hard palate and there is a perforation. Some two or three years ago Dr. Beck showed me a beautiful case of atrophic degeneration of the nasal cavity in which the sinuses were wide open. You could look in through the roof of the mouth which had been destroyed, and there was a complete picture of the whole cavity. You could see the sphenoid, antra and the ethmoid cells and their openings and likewise the openings into the frontal sinuses. This was a beautiful picture. There was a complete destruction of the hard palate, as I told you before, and yet this had gone on. Whether or not the atrophy was preceded by the syphilis or the syphilis had followed the atrophy, which was more probable, there necessarily had been at first an exudation of mucus into the nasal cavity, and yet with all this forcing of the mucus from the mouth into the nasal cavity this atrophic degeneration had continued and, when I saw the case, it was still in process of degeneration. Since that time, Dr. Beck has told me that he was able to bring about complete relief with the paraffin injections. I can understand why the paraffin should be used for temporary relief because of the inflammation brought about by the injection into the sub-cutaneous region. There would be an exudation of leucocytes and mucus, and a building up of the mucous membrane, bringing it back to a functioning condition. Of course there is a time when this must stop and atrophy must again take place, but if we can only give these patients temporary relief we have at least done them some service.

DR. BALDWIN, Philadelphia, Pa.: I read a paper on this subject before the Laryngological Section of the American Medical Association three years ago, pointing out the desirability of equalizing the air space on the two sides by correcting the deformed septum. It might be an advantage in these cases where there is great deformity to correct the septum first. In addition to syphilis as a predisposing cause of atrophy, heredity goes a great ways. Where atrophic rhinitis has gone through family after family you will find it manifests itself in children only two, three or four years old. In some of these cases you will get no syphilitic history as far back as you can trace them. In others I have inquired and found that the fathers or grandfathers or great grandfathers or grandmothers had syphilis and no manifestation of syphilis in the atrophic case,

other than atrophic rhinitis which sometimes was associated with atrophic conditions of the throat and larynx as well. In one case where the nose had been very much involved and the larynx to some extent, years afterwards the eyes became involved and yielded to nothing but very large doses of potassium iodide. That confirmed my opinion that the nasal trouble was a manifestation of inherited syphilis. There was a direct history of syphilis in the immediate family.

DR. STUCKY, Lexington, Ky.: Anything that promises to contribute to the relief of this offensive trouble is always of interest. I do not feel competent to discuss the methods suggested by the essayist, but I am anxious to wait and see the results. There are two things I wish to mention that have given me better results than anything else. It matters not whether I got a history of syphilis or not. It matters not whether I suspect syphilis or not, the constitutional treatment which is always indicated, I believe, and has given me the best results, is to push the iodide until you get an increased discharge of mucous from the nose, then to give a sufficiently large dose to keep the patient well under the influence for several months. So much for the constitutional treatment. Now, the local treatment. Instead of using the douches *ad infinitum* and eternally, there has nothing given my patients so much relief as crude petroleum, or coal oil. They may object to it a little bit at first, using it as a spray, but after a couple of days the relief is so marked that they no longer object to it. I would be very glad to hear a report in a year hence from the use of these two remedies for two or three months at least. Iodide of potassium internally and crude petroleum oil sprayed two or three times a day.

DR. GOLDSTEIN, St. Louis, Mo.: As I understand the main principles developed in this paper and the canula by which Dr. Iglauer establishes an artificial oro-nasal passage, it is to introduce the salivary secretion and get its beneficial effect on the atrophic mucosa. If that were sufficient to regenerate the mucosa or to bring about a satisfactory condition in these atrophic areas, no matter what their etiology or pathology might be, an analogous condition ought to exist in atrophic states as we find them in the pharynx and larynx. Here no artificial measures are necessary to establish free lubrication of the pharyngeal and laryngeal surfaces; and still those of us who have had occasional cases of localized pharyngeal and laryngeal atrophy are impressed with the fact that the treatment of these conditions is almost as unyielding as those of the nasal mucosa.

If the lubrication by the salivary secretions is the main feature developed in this paper, I fail to see the practical value of this artificial sinus, for it has not been established as a definite measure for improvement or cure in similar conditions in the pharynx and larynx where no such artificial agencies are brought to bear on the case.

DR. BALLENGER: I do not feel competent to discuss the merits of this new method of treatment, but I do not anticipate that it will prove to be entirely satisfactory, although I do believe that it may be of benefit in some cases. The point I wish to raise is the one raised in the paper, namely, the position that Gruenwald takes, that all cases of atrophic rhinitis are due either to a sinusitis or to a focalized suppuration somewhere in the nasal cavities. I recently reviewed his book for my own purposes, not for publication, and just at that time I had what appeared to me to be a well marked case of atrophic rhinitis, with the most horrible ozæna that I have ever encountered, in a lad about seventeen years of age. He lived below the stock yard and was unable to detect any odor in passing. Before coming to me, he had been in the hands of one of our most eminent rhinologists for two years, who had treated him for atrophic rhinitis by washing and the removal of crusts. He came to me and I made the same diagnosis, atrophic rhinitis. On reading Gruenwald again, I determined, since the case was desperate, to give Gruenwald's theories a chance and open up the ethmoidal and sphenoidal cells, which I was sure were involved in the process, if it were a sinusitis. I therefore performed an intra-nasal operation, removing the middle turbinated body upon his right side, then currettng the ethmoidal cells as thoroughly as I could do it, breaking down the anterior wall of the sphenoidal sinus with the curette. To my surprise, the odor disappeared in one or two days. The discharge ceased inside of a week. The crust formation and ozæna disappeared in a week's time on that side. I was emboldened by this success to attack the other side by the same method, which I did very thoroughly. This side yielded just as quickly. In one week's time from the last operation he was dismissed. It is now some six or eight months, and I heard from him a very short time ago, and he still had perfect relief from the crust formations and from the ozæna. I do not want to be understood as advocating Gruenwald's theory as to the origin of atrophic rhinitis. I simply recite this case as one that was diagnosed by an eminent confrere of mine as atrophic rhinitis, and that yielded to the treatment for sinusitis.

DR. DEVILBISS, Toledo, Ohio: I have been trying to recollect the name of the physician in Texas who has been in the habit of using a solution of pepsin for atrophic rhinitis for the purpose of softening the crusts for removal.

I think Dr. Iglauer's salivary secretion would act in about the same manner as the solution of pepsin. This doctor says he has less trouble with the cases in which he uses a solution of pepsin as a cleanser than with anything he has ever tried. I have not tried it. He said he had used it for many years and with marked benefit. I believe that the atrophic process whether in the spinal cord or the ear, is similar and continuous, whether it be of traumatic origin or of an origin we know nothing about.

DR. BECK, Chicago, Ill.: This is an admirable work of the author, Dr. Iglauer, and it opens a great field for discussion, possibly a greater field than we are able to do justice. I can imagine what a physiologist or a man like Dr. Kyle of Philadelphia would say concerning the function of the salivary secretion and the forcing of the necessary saliva up instead of down. He would be considering what the effect of forcing it into a foreign region will be on the gastric secretion. However, that is to be seen. The conditions which will be brought about certainly gives us a great field for investigation. It is an unnatural fistula, and I am opposed to it because all modern operators on the sinuses object to the opening of a sinus into the mouth. I shall want to hear what the rest of the fellows will say about this cure of atrophic rhinitis, before making this opening. It is a heterogeneous process, although it may work. Concerning the case Dr. Kyle of Indianapolis spoke of, it was an ordinary case of gumma with a destruction of the floor of the nose, the roof of the mouth; and I simply show it occasionally to show how nicely the sinuses may be studied from it. I did not inform him that I cured the case by paraffin injection. As to these openings, if there is any affection of the voice the smallest opening will give a nasal twang. These openings will close unless they are quite large. Any of you who have had patients with tubes, in the treatment of the antrum of Hymore know they are not pleasant. I was in hopes Dr. Freudenthal would be here this morning to speak of the various radio-therapeutic agents. If there is anything that will prove a valuable therapeutic agent in these cases of atrophic rhinitis it will be something in that line.

An operation such as Dr. Iglauer has described for atrophic rhinitis was done by Dr. Graham (dentist), of Chicago, for the cure of

antrum disease. He made the opening from the mouth through the hard palate into the antrum and introduced a button to keep it open.

DR. IGLAUER (closing): I am delighted with the discussion, especially with its scope and extent. I think some of the gentlemen failed to discuss the essential feature, whether the theory of my method will hold. Regarding the deviation of the septum of course caution must be used. This canula should not be introduced into a very narrow nasal fossa. You must look and see if there is room for the canula before you operate. No doubt an unequal division of the incoming air between a narrow and a wide nostril would modify the course of the disease. However, I do not believe that, in most cases of this disease, we complain of too narrow a nostril but rather of one too wide. In regard to syphilis, in Case II. I had a good deal of doubt whether the patient had syphilis or not, as he had a large perforation of the septum; but he had some other symptoms of atrophic rhinitis which I was trying to relieve. Although I put him on anti-syphilitic remedies, I still persisted in this method, and by the combined treatment this patient has been much improved. I agree with Dr. Stucky that we must wait for results. All I claim is that I am encouraged. Results have not been at all unsatisfactory. This method in a measure supplants the douche. Patients gradually come to rely upon the saliva and they seem to get a great deal of satisfaction in keeping the nose clean in that way. The mere presence of moisture will prevent the beginning formation of crusts. I believe, too, that these crusts are not entirely formed from the nasal secretions, but they are partly made up of soot and dust, and if the nose is kept moist, the formation of this sticky paste is prevented. Dr. Goldstein brought up the question as to whether the saliva would have the desired therapeutic effect and cited as an example that the pharynx and larynx were normally bathed in saliva and still became diseased. I am not aware that saliva enters the larynx. I thought it went over the larynx like any other fluid. As regards the pharynx, pharyngitis is usually a complication of the atrophic process and is secondary to the nasal atrophy. In these cases you will always find more dryness on the posterior walls of the pharynx than on the lateral walls. The posterior wall, I think, receives less saliva than the lateral wall. Further, the disease is usually in the naso-pharynx and gradually extends down into the moist oropharynx. As to the larynx, since no saliva enters the larynx that argument falls away. I further made the point that this disease does not enter the mouth. And why? Either because of the saliva,

or because of the structure of the oral mucous membrane. One gentleman brought up the subject of pepsin. I did not mention it in the paper but there might be some digestive action of the saliva upon these crusts. There is not much starch in the nose, aside perhaps from vegetable matter that is inhaled as dust. That perhaps would undergo a change into sugar, and some day I may try to work that out and see if I can find any sugar in the nasal secretions. Dr. Kyle makes the statement that the nasal secretions are identical with those of the mouth. He speaks of three ferments in the saliva. If these were present in sufficient strength, we should have an additional digestive action going on, and might be able to digest these crusts as they form. I am inclined to agree with the trophic theory and it seems to me that atrophic disease is a nutritional disease. As to the involvement of the sinuses, I should certainly rule out sinus disease before attempting any radical procedure.

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## EXPERIMENTS ON ANIMALS WITH ETHYL CHLORIDE.

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In presenting the results of our experiments on animals, we wish to say that the subject has not been thoroughly worked up as we had hoped it might be at this time, so we are obliged to present a very incomplete preliminary report. The material from which our conclusions are drawn, consists of the observations obtained, from a series of experiments on eighteen dogs. The research was undertaken with the object of determining the effect of Ethyl Chloride upon respiration, heart and blood pressure, and also the causes of death. We also sought to determine the practicability for prolonged anaesthesia.

The method of administration was in the form of the gas which the animal was allowed to inhale from a metal mask, which was placed over the nose and mouth or attached to the tracheal cannula, and to which the Ethyl Chloride container was connected by means of a rubber tube. The mask was provided with a valve which allowed the expired air to escape readily and also a certain amount of air to be mixed with the gas at each inhalation. The amount of air in the mixture was varied with different animals and also in the same animal.

There was no means of estimating the amount of air in the mixture therefore we are unable to draw conclusions as to its practicability for prolonged anaesthesia. We have however a method in mind by which we hope to determine this question at a later date.

### TIME REQUIRED TO ANAESTHETIZE.

Of the eighteen dogs, one (dog 3) we were unable to anaesthetize with ethyl chloride but this same animal took two ounces of ether later and was not fully under. The anesthetic was changed to A. C. E. mixture and he was fully anaesthetized three minutes later. In one animal the time was not noted. Of the sixteen remaining dogs the minimum time for anesthesia was 45 seconds the maximum time 4 minutes. The average time 110 seconds.

## DEGREE OF ANAESTHESIA.

In our earlier experiments, we aimed at the degree of anaesthesia which we were accustomed to observe with ether and chloroform, i. e. the abolition of all reflexes. We found later that this was not necessary, and in fact, not advisable; for when this degree of anaesthesia was reached we bordered on the danger period. Of the eighteen dogs, 5 had all reflexes abolished while the remaining 13 had conjunctival reflexes present, or even incomplete muscular relaxation.

It was found that operation could be performed on these unrelaxed animals without their showing any evidence of pain. The operation consisted in placing a cannula in the trachea, (through which the anaesthetic was afterward administered), and a cannula in the carotid for blood pressure tracings; the time occupied in this operation was from two to four minutes. The anaesthetic was usually stopped entirely during this time.

## AS A PRELIMINARY TO ETHER AND CHLOROFORM.

In twelve of the dogs, the anaesthetic was changed to ether after the tracheal cannula was inserted. In all cases (except Dog 3 already mentioned), they took the ether without any struggling or evidence of laryngeal irritation. In one dog the anaesthetic was changed to chloroform in which case the animal stopped breathing.

## EFFECT ON BLOOD PRESSURE.

Wood and Cerna<sup>1</sup> who experimented upon rabbits, observed an increase in respiratory movements and a decrease in arterial pressure during narcosis, with an immediate return to normal as soon as the anaesthetic was stopped.

The heart rate is first diminished in frequency and then increases later in the experiment.

Ruegg<sup>2</sup> of Basle later took up the investigation, and admits there is primarily a slight fall of blood pressure, which he attributes to the administration of a dilute vapor, where a vaso dilatation occurs, but increase of vapor strength immediately counteracts this effect by increase of the heart's action, any further fall of blood pressure he attributes to toxic doses.

In twenty-two cases of our series where the effect on blood pressure was recorded, seventeen cases gave a primary fall, varying from 13 mm. to 100 mm. of mercury. Average fall 50 mm. Two cases

<sup>1</sup> Taken from article by Charles Greene Cumston in *Boston Med. and Surg. Journ.*

<sup>2</sup> Taken from article by Thos. D. Luke in *Edinburgh Med. Journ.*



gave a slight gradual rise. Three cases gave a rise followed by a fall.

By consulting Table No. 1 it will be seen that in nearly all cases, there is a more or less marked fall which we can say positively is not due to the vapor being too dilute, for in some of these cases an increase in the anesthetic causes a further fall. (Fig. 1.)

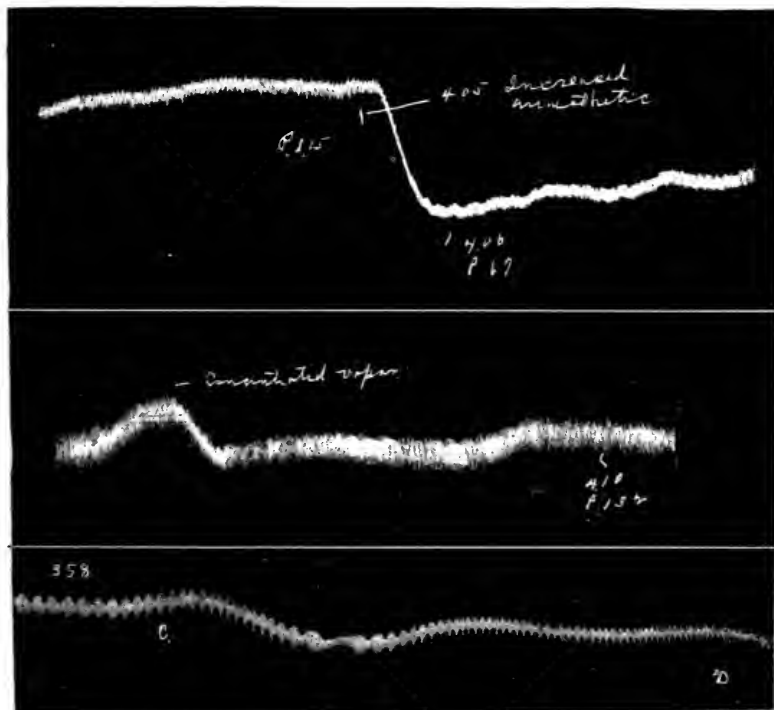


Fig. 1. Increase of Ethyl Chloride causing further fall of blood pressure.

It will also be noticed that in a number of the cases where the pressure recovers towards normal, (or where there is a secondary rise), there is a tendency to asphyxia or increased respiration and even convulsive movements. (Fig. 2.) This may in part explain the cause of the rise.

Our experiments would therefore tend to agree with those of Wood and Cerna; but as previously mentioned, we are not justified in drawing any definite conclusions, until a means has been devised, whereby the amount of air given with the anaesthetic can be estimated.

## EFFECT ON RESPIRATION.

The respiration was observed upon eight dogs. Four of these showed a marked increase while in three it was slowed. In one

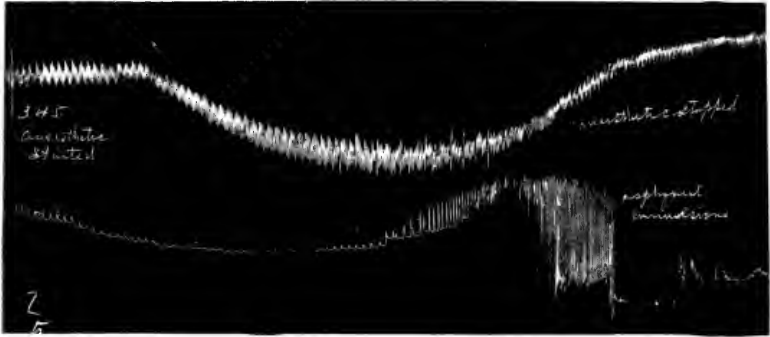


Fig. 2. Asphyxia accompanying rise of blood pressure. Lower tracing respiratory.

case the heart and respiration ceased suddenly without any warning. This observation was repeated four times upon the same animal. The cessation of the heart in each case was due to vagus stimulation

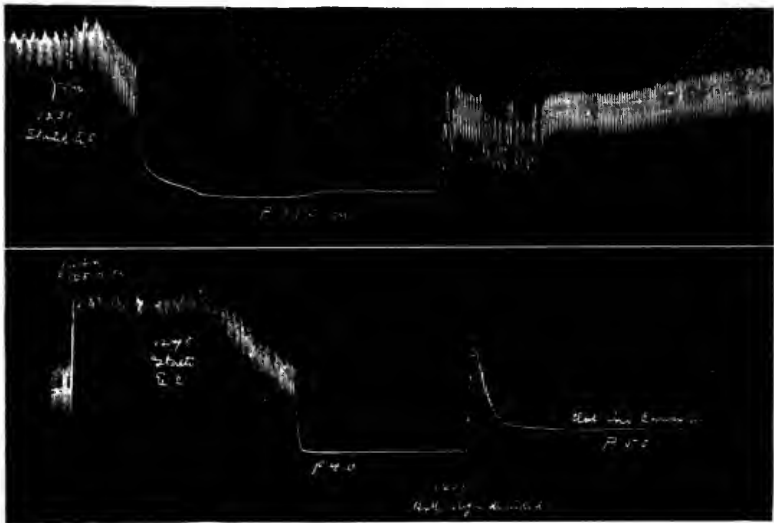


Fig. 3. Stoppage of heart due to vagus stimulation. Upper tracing heart starts spontaneously. Lower tracing vagi are cut and heart starts immediately. Clot in cannula prevents tracing.

and there was probably a paralysis of the respiratory center occurring at about the same time. (Fig. 3.)

Recovery took place spontaneously in each instance, except one where artificial respiration was employed; and the last, when the heart started immediately after section of the vagi but the respiration did not recover. The vagus stimulation therefore involves the center, and is probably reflex, and similar to the primary vagus stimulation by choloform.

#### EFFECT ON THE HEART.

In twenty-two cases where the effect of administration was observed upon the heart, there was an increased heart rate in eight cases. In one of these eight cases there was slowing which came on later due to vagus stimulation. (Fig. 4.) In thirteen cases there was slowing, five of these were plainly due to vagus stimula-

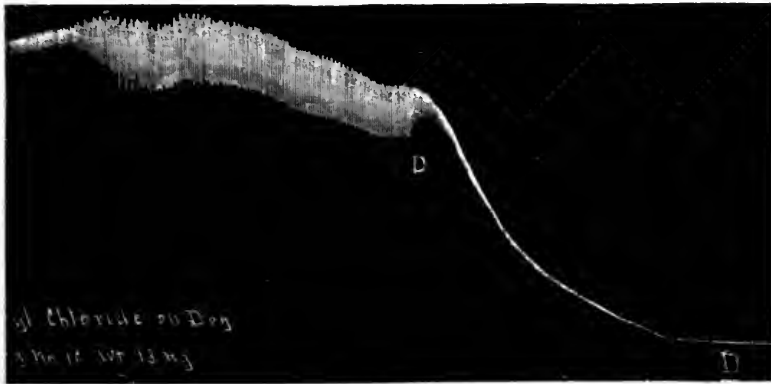


Fig. 4. Prolonged administration. Heart stimulated (reflex vagus stimulation) to increased excursion with a sudden weakening and fall of blood pressure.

tion. In one case there was no change in rate throughout the time which the anaesthetic was given. From the five experiments done it is quite evident that Ethyl Chloride has an effect upon the heart through the vagus center, and probably a depressant action on cardiac muscle similar to that of chloroform.

#### EFFECT ON THE EXCISED HEART.

One experiment was made on the excised dog's heart by Langendorff's method. The heart was perfused with Locke's fluid when the organ began to beat at the rate of 142 per minute. The perfusing fluid was then changed to Locke's fluid containing less than 1% ethyl chloride. The heart became slower and weaker at once.

It is revived again by pure Locke's fluid but does not return to the original rate and strength. This was repeated the second and third time. Each time the heart became weaker and finally stopped. On examination the cardiac muscle was found to be in rigor.

TABLE No. 1.

Dog	Observation	Time after anæsthetic started	Primary effect	MM of Hg	Secondary effect	Accompanying Rise
1	1	1 minute	Fall	24	Rise	Convulsive movements.
	2	1½ minutes	Fall	13	Rise	Convulsive movements.
	3	½ minute	Fall	20	Rise	
	Increased anæsthetic	½ minute	Fall	48	Sl. rise	
2	1	6 minutes	Fall	43	Rise	Deeper respiration.
	2	4 minutes	Fall	47	Rise	
	3	1 minute	Fall	94	Sl. rise	Respiration shallow.
	4	8 minutes	Fall	100	Toxic Dose.	
3	1	2 minutes	Fall	32	Rise.	
	2	1 minute	Sl. rise			
	3	½ minute	Rise	30	Fall	
4	1	5 minutes	Rise		Rise	Asphyxia.
	2	3 minutes	Fall	50	Rise	Asphyxia.
	3	2 minutes	Fall	20	Rise	Asphyxia.
	4	1½ minutes	Fall	50	Rise	Asphyxia.
	5	2 minutes	Fall	30		Asphyxia.
10	1	1½ minutes	Fall	100		Respiration and heart ceased.
	2	2 minutes	Fall	80		Respiration and heart ceased.
	3	1 minute	Fall	66		Respiration and heart ceased.
	4	1 minute	Fall	65		Respiration and heart ceased.
11	1	10 minutes	Rise slight	Fall		Toxic.
12	1	6 minutes	Rise	16	Fall	Toxic.
14	1	3 minutes	Fall	70	Toxic	Cord and vagi divided.

## CENTRAL VAGUS STIMULATION.

This effect was observed on three dogs of the series. In each case the heart stopped completely, in two it started immediately after section of the nerve while in the third it failed.

## CESSATION OF HEART AND RESPIRATION.

Observations were made upon eleven dogs, and during the observations respiration ceased sixteen times. The respiration ceased five times when the heart did not stop. In each instance, it

was revived by artificial respiration. In the remaining eleven cases, the heart also stopped. In six of these cases the respiration ceased before the heart. In one case respiration ceased after the heart. In two cases it ceased with the heart. In two cases the time was not noted.

The results are given more in detail in Table No. 2.

TABLE No. 2.  
CESSATION OF HEART AND RESPIRATION.

Dog.	Heart.	Respiration.
1	Stopped. Revived after 10 minutes with adrenalin.	Ceased. Time not noted.
2	Stopped.....	Ceased. Revived by artificial respiration. Ceased $1\frac{1}{2}$ minutes before heart.
3	Stopped.....	Ceased. Time not noted.
4	Stopped.....	Ceased. Revived by artificial respiration. Ceased $\frac{1}{2}$ minute after heart.
6	Stopped.....	Ceased. Revived by artificial respiration. Ceased 5 minutes before heart.
8	.....	Ceased. Revived by artificial respiration.
10*	Stopped. Starts spontaneously after 5 minutes.	Ceased with heart; starts spontaneously a few seconds after heart.
	Stopped.....	Ceased $1\frac{1}{2}$ minutes before heart. Artificial respiration.
	Stopped. Starts spontan.....	Ceased 2 or 3 seconds before heart; starts spontaneously $\frac{1}{2}$ minute after heart.
	Stopped. Vagi divided; starts immediately.	Ceased with heart; does not start.
11	Stopped.....	Ceased 2 minutes before heart.
12	Stopped.....	Ceased $\frac{1}{2}$ minute before heart.
14	Stopped.....	Cord and vagi are divided. Artificial respiration throughout exp.
15		Ceased. Revived by artificial respiration.

\* Note. The cessation of the heart in this animal was plainly due to vagus stimulation.

#### PROLONGED ADMINISTRATION.

Prolonged administration was tried on nine of our animals. In all cases there was either asphyxial convulsions, cessation of respiration or stoppage of the heart. The minimum time was  $1\frac{1}{2}$  minutes, in which case the heart stopped. The maximum time was 27 minutes in which case the anaesthetic was stopped owing to asphyxial convulsions. For length of time given in each case see Table 3.

## CAUSES OF DEATH.

In eight of our animals where death was due to ethyl chloride, which includes those on which we sought a fatal termination in order to determine the cause of death, we found: In two cases death was due to asphyxia. In three cases death was due to cessation of the heart. In three cases death was due to paralysis of respiration.

TABLE No. 3.  
EFFECT OF PROLONGED ADMINISTRATION.

Dog	Length of time given	Effect
1.....	27 minutes.....	Asphyxial convulsions.
2.....	25 minutes.....	Asphyxial convulsions.
3.....	18 minutes.....	Asphyxial convulsions.
4.....	21½ minutes.....	Asphyxial convulsions.
6.....	5 minutes.....	Died.
10.....	1½ minutes.....	Heart stopped.
11.....	14 minutes.....	Respiration ceased.
12.....	26½ minutes.....	Respiration ceased.
14.....	8 minutes.....	Respiration ceased.

## CONCLUSIONS.

From our limited numbers of experiments and the method of administration we may draw the following conclusions:

1. It is rapid in action and causes little struggling in comparison with ether.
2. It is practicable as a general anesthetic for short operations.
3. It is not necessary that reflexes are abolished before sensibility to pain is lost.
4. It is practicable as a preliminary to ether and chloroform.
5. It causes a lowering of blood pressure comparable to that of chloroform.
6. It seems to first stimulate and later paralyses the respiratory center.
7. It has an effect upon the heart through the vagus center, tending to cause stoppage of the heart, in the same manner as is seen in the early period of chloroform administration.
8. The experiment with the excised heart indicates that ethyl chloride has a direct depressant effect on the cardiac muscle, similar to chloroform.
9. It is not without danger when the administration is prolonged, and is not practicable for prolonged anesthesia, at least by the present method of administration.

## CLINICAL REPORT.

Up to the present time, we have used ethyl chloride as a general anaesthetic in 200 cases, the youngest of which was 10 months, the oldest 68 years.

In only two cases were we unable to anaesthetize the patient, using the old form of mask where the ethyl chloride was sprayed into the top.

There was nausea and vomiting in but two cases of the series and this may have been due to swallowed blood, following tonsillectomy and adenectomy.

The time required for anaesthesia was from one-half to three and one-half minutes. This agrees very closely with the time required in our animal experiments.

The duration of anaesthesia was from one to four minutes. The operations consisted in the removal of tonsils and adenoids, paracentesis, opening of abscesses, etc.

Since using the improved form of mask where the vapor only enters the mask, there has not been any cases in which we failed to anaesthetize. It has also been used successfully as a preliminary to ether and chloroform in twenty-six cases.

## DISCUSSION.

DR. HAWLEY, Chicago, Ill.: As early as 1848, Heyfelder used Ethyl Chloride as a general anesthetic, and in 1886, the British Medical Association, after experimenting with the drug, condemned its use as being too dangerous, producing convulsions and arresting respiration. About 1895-6 it was again brought to the front by Carlson and Thursing, and was soon used extensively in dental work.

Seitz of Konstanz in 1892, reported sixteen thousand cases, with but one death, and that in a very unfavorable subject. With the exception of Nitrous-Oxide gas, he considers it the safest of all anesthetics. Opisthotonos was observed in three cases; all three, however, were addicted to the use of alcohol.

Burnett in the Medical Press of 1902, considered Ethyl Chloride an ideal anesthetic. He used it in a concentrated form, and found it caused more relaxation than Bromide of Ethyl, though not as much as chloroform.

McLennan in the Glasgow Medical Journal, 1902, places it on a par with laughing gas for safety. The stage of anesthesia is longer than in Ethyl Bromide. H. Gerard published an elaborate study on

the subject, but the report of his cases hardly justifies his conclusion. In seventy-eight cases, there were four failures to come under its influence. In nineteen, the pre-anesthetic period ran from five to thirty-eight minutes. In the majority of cases, the anesthetic period was not continued more than ten minutes. The pupils dilated in eighty-five per cent, corneal reflex was absent in forty-nine, excitation was noticed in sixty-seven per cent and at times was quite violent. In fourteen cases there was arrest of respiration, lasting fifteen seconds, vomiting in thirty-nine per cent, sweating in twenty-six per cent and increased rapidity of the pulse, running up to one hundred and sixty per minute. Albumen is generally present in the urine, sometimes found twenty-four hours after its use.

Golden in the New York Medical Journal, classes Chloride of Ethyl with internal poisons, and says it must be used with greatest care, and only in brief operations. Due to this fact, it cannot be compared with either Ether or Chloroform in prolonged operations. However, in short operations, he considers it safer than Chloroform, but not as safe as the Bromide. Both should be used with the patient in a recumbent position, and with a free accompaniment of air. T. O. Allen, in the American Journal of Medical Science, 1903, reports one death, but does not state the number of cases upon which it was used. The case was a colored man, twenty-eight years of age, epileptic, who was to be operated upon for inguinal hernia at the Pennsylvania Hospital. Anesthesia was started with Ethyl Chloride and was used until near narcosis when Ether was substituted. At that moment the patient gagged, and vomited enormous quantities of a clear watery liquid, which seemed to flow from his mouth without any apparent retching. Both respiration and heart action ceased, and all efforts to restore them were fruitless. This death, in my opinion, however, cannot justly be laid to the use of Ethyl Chloride.

In twenty-four cases of minor operations reported by McCardie, the longest case lasting sixteen minutes, no unpleasant effect was produced by the use of Ethyl Chloride, excepting in one case, where the patient died an hour afterwards from heart disease, the autopsy showing fatty degeneration. About ten c. c. of this drug was used in each case. The whole number of cases collected by McCardie was sixteen thousand, with but one death, and twelve thousand four hundred and thirty-six are reported by M. W. Ware, with but one death. Such men as Pfester, Erdman and Craig place Ethyl Chloride above either Chloroform or Ether as to safety in its use, and consider it only surpassed by Nitrous Oxide Gas. Even



here it gives a longer narcosis, is less unpleasant to take, induces narcosis more quickly, and (which sometimes is quite an item) is cheaper. The greatest objection offered is the rapidity with which the patient frequently passes out from under it. Like gas, the anesthesia, caused by Ethyl Chloride can be continued by means of Chloroform or Ether. Ethyl Chloride should not be crowded, for if the vapor is too concentrated it may produce asphyxia. Vomiting which sometimes occurs is not so marked as with Chloroform or Ether. Lotheisson, after carefully considering all the reported cases of death from Ethyl Chloride, claims that statistics show it stands next to Chloroform as to mortality; the latter giving one death to every two thousand and seventy-five, while Ethyl Chloride presents one death to every two thousand five hundred and fifty.

In June of the present year, Chaldecott, before The Society for the Study of Diseases in Children, after speaking of the many advantages possessed by Ethyl Chloride ended by saying "it is very clearly laid down that the agent in question is a very powerful anesthetic and should, except under circumstances of extreme urgency only be administered to patients who have been properly prepared." When we consider the various and diametrically different opinions herein given, regarding the safety and non-safety of Ethyl Chloride as a general anesthetic, we are forced, I believe, to the conclusion, that other elements, independent of the anesthetic itself must have been present in many of these cases to produce death. It is not always easy to assure one's self that death is due solely to the anesthetic given, whatever that anesthetic may be. It is difficult to eliminate the many elements which may be present at the time, any one of which may be the cause of death instead of that particular anesthetic used. Improper use and impurity of the drug, surgical shock, or some idiosyncrasy on the part of the patient himself, are few of the causes of death independent of the character of the anesthetic selected. It is impossible, judging simply from the statistics herein given, to state positively which of the two anesthetics now generally used in short operations about the ear, nose and throat, namely Bromide and Chloride of Ethyl, is the safer, each possessing distinct advantages. Although the patient may yield to the influence of the Bromide more quickly than the Chloride, and while a sudden awakening from an apparent complete narcosis may occur under the use of the Chloride; we must still consider the ease with which the patient passes through the various stages of unconsciousness, when acted upon by the Chloride, the length of time it can be used (56 minutes being recorded) and the preponderance of evidence as to

its safety, "before we hesitate to consider Ethyl Chloride *par excellence* as an anesthetic" in all short operations on the ear, nose and throat.

After more or less constant use of Ethyl Chloride, for over seven years, both in clinical and private practice, I have still to see the first case in which its use has caused me the slightest fear or uneasiness. This I cannot say of the Bromide, where but recently a death occurred in this city during its use. I do not hesitate, therefore, to say that when used with care and understanding and in proper and selected cases, I prefer it in short operations to all other anesthetics now in use, except perhaps Nitrous Oxide Gas. As in all anesthetics, certain precautions must always be taken in administering Ethyl Chloride. *First*, the patient should be prepared as for Chloroform or Ether; *second*, whatever mask is used must fit the face snugly; *third*, the anesthetic must be well supplied with air and as little given as possible, care being taken not to present it at first in too large a quantity. Frequently a dram is quite sufficient for short operations. It is advisable to insert between the teeth a prop or gag before beginning to administer the anesthetic. Also the patient should rest for a while after its administration, as faintness sometimes supervene. A mask should be used which does not receive the drug close to the patient's face. For this reason, I much prefer the Apperson Inhaler to any other now in use. Many preparations of Ethyl Chloride now upon the market are impure and unreliable. An examination of fifty specimens showed thirty unfit for use, due to impurity of the drug. In all short operations, while administering the anesthetic, I generally have the patient hold one arm up. When it falls, I wait a short time before removing the mask, to assure myself that the patient is sufficiently under the influence of the anesthetic to operate. If the patient becomes materially excited or cyanotic the mask should be removed at once.

One is generally governed in the selection of an anesthetic by his own experience in its use. If he is so unfortunate as to witness the death of an individual, while under the influence of an anesthetic, that anesthetic will ever afterward be shunned, or used with fear and trembling, in spite of the fact that death may have been due to causes acting independently of the drug. Conclusions are formed and statistics given which are often misleading from this very fact. All conclusions and statistics therefore should be taken *cum grano saltis* if we wish to come to any correct and positive understanding of this subject. A careful study of all deaths occurring while under the influence of anesthetics must be made and a scientific knowledge of

their physiological action upon the lower animals as well as upon man, must be obtained by experimental research, conducted along lines similar to those presented in the interesting paper of Drs. Large and Brown, before we can positively answer the question: Is Ethyl Chloride the safest anesthetic to be used in minor operations about the ear, nose and throat?

DR. MURPHY, Cincinnati, Ohio: I have been using Ethyl Chloride in minor operations. I find that it is an ideal anesthetic in those cases where we can operate, say, within a minute and a half to two minutes. The rather pleasant sensation in taking the anæsthetic is one of its great advantages. Patients do not struggle, and usually in half a minute, sometimes less, the patient is anæsthetized sufficiently for doing ordinary operations such as tonsillotomy.

I do not wait until the reflexes are abolished, but find by having the patient snap the finger that the moment they cease snapping there is enough anæsthetic to remove the tonsils. In one of my aural cases we found the mask was not working well. The patient had only taken a few inhalations when I noticed she was getting too much ethyl chloride. It seemed to be running through the mask. I spoke to the assistant and said the mask was not properly adjusted. The patient heard me say it as I removed the mask. The time from the beginning till the end of the complete removal of both tonsils was one minute. The young woman said she had had a pleasant dream, and did not feel the least pain in the operation.

I have had no unpleasant experiences with the anæsthetic whatever, although we realize there is no anæsthetic absolutely devoid of danger.

DR. GOLDSTEIN, St. Louis, Mo.: Since Wingrave's admirable monograph on adenoids was published, presenting a rather complete discussion of the field as it stands today, I have used Ethyl Chloride, not pure but in the combination recommended by the British Laryngologist, with Nitrous Oxide and Bromide of Ethyl, and as such it is an excellent anæsthetic. In most of my cases where the tonsils or adenoids are concerned, the patient is placed in an erect position; and the great value of this form of anæsthetic is that the patient is anæsthetized quickly, that the effects of the anæsthetic wear off almost immediately after the operation, and the patient is able to expectorate, gargle, etc.; and there are no after-effects. These are the important, practical features which recommend themselves to us in this work.

It is an æsthetic way of performing minor operations, and as such I think it ought to command our attention. I even went so far

some two years ago as to do a radical mastoid with this anæsthesia, and there were no evil effects. I cite this to show to what extent an anæsthetic of this character might be used, not to recommend it for protracted anæsthesia.

DR. BECK, Chicago, Ill.: Mr. President, I just wish to add a word to the remarks made by Dr. Goldstein in connection with this paper. I was present at an operation where this combination was used, and I operated on tonsils and adenoids and the surgeon did an operation on the saphenous vein. He said: "He is sleeping so nicely, go ahead with the stuff." And the anæsthetist was told to go on, and the operation was completed. The after-effect from this combination in this particular case, in which the patient was thoroughly prepared for the operation, was a very disagreeable one. For a week or ten days they had to take measures to stop the nausea. The dentist said he had given it for a long protracted case of extraction of the teeth and work on the mouth, and it never had any such effect. Possibly it was purely a coincidence, but in protracted cases it is not to be encouraged. I have used in the Illinois Eye and Ear Infirmary the Ethyl Chloride in cases and I like the anæsthetic very well. Since then, somniform has been introduced, and I have used it. It is to be recommended.

DR. IGLAUER, Cincinnati, Ohio: I have had some experience with this anæsthetic, and on the score of safety, I believe it ranks with ether. From the study of statistics as to mortality it appears to be about the same as ether. Of course, Ethyl Chloride has not been in use as long as ether, so these figures are purely tentative. In the use of this anæsthetic in nose and throat work, there is one point I should like to make, and that is you do not have complete relaxation. Dr. Brown says in the paper that it is best not to abolish all the reflexes. Owing to the brief period of anæsthesia one must operate quickly. The other day I had difficulty in getting a child's mouth open in order to get at the adenoids. I should therefore suggest that you insert the gag before you begin with the anæsthetic, which, however, will often frighten the child, or that you give more of the anæsthetic after the gag has been put in place. The advantage of this anæsthetic is its great rapidity, the pleasant odor and the fact that it is easily porable. While I believe gas to be much safer than Ethyl Chloride, still we always have to have a heavier apparatus.

DR. BROWN (closing): Dr. Murphy, in his remarks, speaks of the anæsthetic as being easy to take. That is one of the very nice features about it. I have taken it myself just for the novelty of it.

You can sit in a chair and take it, and you do not entirely lose consciousness; that is, a number of the patients do not. They are apparently aware of what is taking place but they feel no pain. He spoke about having the patient snap his finger. That would be a very good indication for the purpose of making it appear how deeply the patient was under the influence of the anæsthetic. You can not go altogether by the reflexes. I would not advise placing the patient so deeply under as to abolish all the reflexes.

Dr. Goldstein spoke of the recovery, and stated that there were no bad after-effects. Dr. Lange found only two cases of his two hundred where there was any nausea following. I have seen it used a number of times on patients. Used on animals, I know they take it very nicely. I have put them under its influence a great many times. They recover from it in about a minute, and have no bad after-effect. Dr. Beck spoke of the case where he had some trouble from the somniform where they kept the patient under some time, because he took it so nicely. I believe the use of Ethyl Chloride is limited to putting them under, and then stopping there, because the medullary centers very soon become paralyzed. But it is not dangerous to use it simply to that extent.

Dr. Iglauer spoke of its comparative safety. In safety I think it is said to rank next to Nitrous Oxide.

About the relaxation, I do not know hardly how you will overcome that difficulty in working about the mouth, because that is one of the things I have noticed particularly, that the jaws are not relaxed in some cases. Probably it can be got around by putting the gag in the mouth before the Ethyl Chloride is administered. I do not think this trouble is a common one, and you will meet but few cases where the jaws cannot be opened.

## MALIGNANT DISEASE IN THE NOSE, WITH REPORT OF CASES.

BY CHARLES L. MINOR, M.D., SPRINGFIELD, OHIO.

In the study of the literature in reference to cases of malignancy in the nose I was impressed not with the rareness of cases, especially sarcoma, but with the very imperfect reports of such cases. There was lacking such points as, hereditary history, previous history of patient, status of patient, age, sex, side of nose affected, appearance of the adjacent nasal structures, the progress of the case after operation or treatment, temperature, any nasal discharge; and above all a complete microscopical report not merely mentioning the fact that the case is one of malignancy but giving the pathologist's reasons for so thinking, and a post-mortem report in full where one has been made. In the review of all the cases reported to which I had access to the literature, comprising about seventy-five cases, I did not find a complete necropsy report.

In view of these facts I report by cases in detail, possibly inserting some points that have no bearing on the case yet which may be of value to others investigating similar cases.

Case I.—Mrs. G. D. age 28, consulted me July 27th, 1903, on account of constant headaches, difficulty in breathing and some discharge from the nose. After examination I diagnosed the case as one of polypi in the left nostril with a deviation of the septum to that side and some adhesions between the septum and inferior turbinated bone. I removed the polypi and the adhesions on September 10th (same year). She was very much relieved until December when she noticed that the opposite side of her nose was becoming stenosed just as the right had been. Upon examination I found that side almost completely blocked with growths resembling polypi, but it was impossible to get any definite idea from which area they sprung. I removed as much of the growth with snare, curette and scissors as was possible, under cocaine anaesthesia, and put her on increasing doses of potassium iodide (until she was taking seventy-five grains) and also a quarter grain of the protiodide of mercury three times a day. She was relieved for a week or two but the symptoms gradually returned until she was worse than she had ever been.

February 13th, 1904, I curetted the whole interior of the right nose very thoroughly under chloroform anaesthesia. The bleeding was profuse. The relief was almost instantaneous. The patient recovered promptly and was sent home in a week. About two weeks later the left side of the nose began to fill up again, and on March 12th, I curetted the same under general anaesthesia. After this she had no further return of the growth up to the time that she went to Colorado Springs. She went to the Springs on my advice based upon the pathological report, after satisfying myself that it was not syphilitic as she did not respond to specific treatment. I had the curettings examined by Dr. F. P. Anzinger, the pathologist to the City Hospital, who believed them to be of a carcinomatous nature.

The growth in the nose was dull grey in color, glistening in spots, soft, a probe being readily passed into it, and bleeding freely when so disturbed. It apparently sprung from the middle turbinal in the beginning and gradually spread to the septum and adjacent parts until at the height of the trouble it completely filled the upper half of the nose.

The following history was obtained:

*Family History:* Mother's father died at the age of seventy-two from gangrene of "the end of the spine." Mother's mother died at the age of sixty-two of Typhoid fever (?) Is said to have had cancer of the womb. Mother's sister died of cancer of the womb at the age of fifty. Father living, in good health. Age sixty-nine. Had cancer removed from his neck at Dayton, Ohio, hospital. (Microscopic diagnosis.) Father's sister died of cancer of the breast at the age of sixty-six. Father's brother had cancer of the lip removed. (Microscopic diagnosis). Still living and in good health. Mother still living, age sixty-four; in good health, but has a lump in her breast. Sister had scrofula in the neck, operated on when aged eighteen. Is now in good health, age thirty-two. Has one other sister and one brother in good health.

*Personal History:* Patient has had measles, mumps, chicken-pox and whooping-cough when small. Malaria at the age of twelve. Has never been robust, yet she has never been very ill. Has always had some female trouble. Never has had any lung trouble. Patient is small of stature, poorly developed, fairly well nourished, florid type. Her family physician reports that she has no lung trouble of any sort, that while not strong, she is not ill. Her female trouble is confined to the uterus and vagina.

*Pathological Reports:* Dr. F. P. Anzinger, reports as follows: "Case D.—Feb. 16th, 1904. Curettings from the nose. Tissue is soft and polyp-like in character. It consists of a stroma of loose connective tissue with a rich supply of small blood vessels. In the stroma are seen localized areas of small cell infiltration, epithelioid cells, and a few giant cells. Localized areas of necrosis and beginning caseation are noted. Scattered throughout the tissue are many atypical gland spaces. The basement membrane is indistinct and broken. The lining cells are atypical as to size and arrangement of chromatin. The surface of the tissue is covered by modified thickened pavement epithelium, which in some places dips deeply into the stroma and in others displays islands of epithelial pearls. The surface in a few places is made up of necrotic tissue. Sections stained for tubercle bacilli are negative. The granulomatous parts of the tissue resemble that commonly found in syphilitic or tuberculous processes. The epithelial proliferation is distinctly cancerous in appearance. Diagnosis—Myxomatous granuloma with superficial carcinomatous proliferation. (Probably not very malignant.).

Dr. S. E. Allen reports as follows: "Looked at the slide of curettings of Mrs. D. and also had Dr. Wolfstein look at it. We think the growth probably Adenoma which has undergone some carcinomatous change, hence an Adeno-carcinoma."

Dr. A. S. Warthin gives the following report: "The section represents a polypoid granuloma with carcinomatous proliferation of the surface epithelium and might be either tuberculous or syphilitic, but there is no positive evidence of either process. There are epithelial areas with characteristic giant cells and also some caseation and fibrous exudate so that the picture resembles both tuberculosis and syphilis. The ultimate diagnosis would have to depend upon the bacteriological examination, that is the section should be stained for the tubercle bacilli. The granuloma is the primary condition and the carcinomatous proliferation is the secondary, the whole picture closely suggesting a lupus-carcinoma so-called."

Judging from the doses of the iodides and mercury that I gave the patient, the granuloma was not syphilitic, I sent her to Colorado principally to have her away from her friends and social functions, and to have her live out of doors and take an abundance of exercise. After she had been there about a year I asked Dr. Levy, of Denver, to examine her nose which he kindly consented to do. He reports as follows: "Mrs. G. D. presented herself a few days ago and after a careful examination of her nose under cocaine and adrenalin, I



found no evidence of a return of the growth. Upon the right side I found moderate adhesions between the septum and the middle turbinal in its middle and between the septum and inferior turbinal anteriorly. Also a small adhesion in the roof of the nose far interiorly. Upon the left side the septum is still deflected of course, and an erosion of moderate size exists on the anterior portion. Her weight is 108 lbs., temperature normal, pulse 100, (probably due to the excitement of the examination). Her general appearance is good, although she does not impress one as being robust."

August 3d, the last time that I saw the patient, she was in the same condition as reported by Dr. Levy with the exception that she had no evidence of the erosion on the septum which apparently disappeared under the use of the ointment prescribed by Dr. Levy some time ago.

Case II.—Mrs. W. W., age 22; was referred to me by the family physician who diagnosed nasal polypi which he thought should be removed. She consulted him on account of catarrh.

*Family History:* Grandparents on both sides have been dead a number of years, but she does not know the cause of death of any except her father's mother who died of cancer of the breast. She does not know at what age. Father died aged sixty-eight, from Bright's disease. Mother living, in fairly good health. She has had one attack of Apoplexy. Two brothers living, in good health; aged thirty-six and thirty-eight. Two sisters living and in fair health. Both have had abdominal sections for female trouble but she does not know the exact nature. Patient has never been ill save with the ordinary diseases of childhood, measles, chicken-pox and whooping cough.

She consulted me on September 19th, 1903, giving the following history of nasal trouble. Never had any nasal symptoms until March of this year when she had an attack of la grippe, which left her with a nasal discharge and occasional stenosis of both sides.

*Status praesens:* Both nares completely filled with polypi. Some discharge coming from above in both nares. Post rhinoscopic examination shows polypi hanging in post nasal space.

*Diagnosis:* Polypi narium with empyema of the ethmoid and probably of the sphenoid cells.

September 21st, I removed polypi from both nares with cold wire snare very thoroughly under cocaine anaesthesia and adrenalin. Very little hemorrhage. Patient had complete relief until the fol-

lowing March when her nose began to be occluded again. The discharge in the nose did not diminish and patient was compelled to use the nasal douche each day.

July 26th, I again removed polypi from both nares with the cold wire snare. As before the patient had almost instant relief. She was comfortable for about four months when it was again necessary to remove the growths. After the removal with snare, curette and scissors under cocaine anaesthesia, the specimens were given to Dr. Anzinger for microscopical report. Patient was relieved this time for only about four weeks, when all the old symptoms returned with the added one of pressure headache. On examination, I found both sides of the nose filled with dull grayish colored growths, no different in appearance from the former growths, but owing to the report of the pathologist the patient was sent to the hospital, was given a general anaesthetic and the whole of the middle turbinates and the areas around were removed with scissors and curette. Hemorrhage at the time of the operation was very profuse, but not so at any other time. Since this operation on April 12th, the patient has been very comfortable, and has had no return of the growth, but the discharge from the sinuses is as profuse as ever although at the time of the operation all the cells were as thoroughly curetted as was possible with the hemorrhage present. I do not report this case as permanently relieved, but merely add it to the report of the other three cases, and expect to report later if there should be a return of the cancerous growth.

*Pathological Report:* "The curettings from the nose consists of two small fragments of tissue resembling polypoid growth but more "fleshy" in consistency and color. Microscopical—the stroma is distinctly myxomatous in character with small round cells scattered throughout. The round cells are larger and contain more protoplasm than the cells usually associated with inflammatory processes. The blood vessels are small and few in number, scattered in groups. Throughout the stroma are numerous gland spaces varying in character. A few are large and cystic, and lined with low columnar pavement epithelium. The majority are medium sized, and lined with ciliated columnar epithelium. The gland spaces are irregular in shape, basement membrane destroyed and the cells atypical in character. The last gives the appearances often termed adenoma-carcinomatousum. They represent the transition from simple adenomatous to the true carcinomatous proliferation. The surface of the growth is largely covered

with ciliated columnar epithelium which in part is eroded and replaced by necrotic tissue. In places the surface is covered with simple pavement epithelium, the cells of which are in part atypical and disorganized. The fragment of tissue shows beginning necrosis in which remnants of atypical epithelial cells may be distinguished. The last is unquestionably malignant.

*Diagnosis:* Polypoid granulations with adeno-carcinoma. (Probably not very malignant.)

Case III: Mrs. G., age fifty, was referred to me in consultation, May 7th, 1905. She complains of violent frontal headaches and inability to breathe through her nose.

*Family History:* Father's mother and father died when very old. Does not know the cause of death or the exact age. Mother's father died, when young, from an accident. Mother's mother living, age, ninety-eight. Father living, age seventy. Has always been in good health until the last few years, when his health failed on account of hard work. (Blacksmith.) Mother living, age sixty-eight; in excellent health. Three brothers living, all in good health. Six sisters living, all in good health. One sister died in infancy.

*Personal History:* The only illness that she has had is malaria. (One attack.) Has had tonsillitis and quinsy nine different times.

*The Present Trouble* began about the middle of September, 1904, when, after blowing her nose violently, she had a severe hemorrhage from the back part of the throat which lasted about an hour. One month later her "head broke" giving rise to a very foul discharge from the upper throat which has kept up ever since, but with treatment the offensive smell has been lessened.

January, 1905, she began to have periodic pains in the head. On the morning of February 16th, she awoke with a violent pain in her head which has continued uninterruptedly ever since, being so severe, that she has not only been unable to do any housework, but even to lie down. March 15th the left eye began to turn in and the sight to fail. She was able however, to focus the eyes with effort until the middle of April, when she had continuous double vision.

*Status praesens:* Patient has the appearance of acute suffering. Head drawn to left side. Height 5 ft., weight 158. Has lost 20 lbs. in the last six months. Temperature 98; pulse 140. Has complete paralysis of the sixth nerve on the left side. Mild optic neuritis of both eyes. Right vision equals 20/40.

There is no swelling or evidence of nasal trouble externally. Left nose is filled with an enormous enlargement of the middle turbinal with usual color of intranasal hypertrophies. Inferior turbinal slightly enlarged. Can not reduce the swelling by the use of Adrenalin Chlorid 1-1000. Very sensitive to touch of probe, but does not bleed. Swelling is hard, giving the same feel when probed as that of the cartilaginous septum. She has a free discharge from the nose but it is not offensive. The right nose has some enlargement of both the inferior and middle turbinates. Transillumination of the Antrum of Highmore and the frontal sinus negative on both sides.

*Diagnosis:* Hypertrophy of the middle turbinate, left side, with empyema of the ethmoid and probably of the sphenoid cells.

Patient was advised and consented to have the nose operated on. When I attempted to remove the middle turbinate with scissors under cocaine anaesthesia the pain was so severe that the operation had to be discontinued. Hemorrhage was no greater than for any ordinary nasal operation. Patient was given tonics and the nose was thoroughly cleansed several times a day until May 16th, when she was placed under general anaesthesia, and the nose thoroughly cleaned out with scissors and curette. The hemorrhage at this time was terrific, but was soon under control after the use of ice to the bridge of the nose and the nape of the neck.

Patient made an uneventful recovery from the operation except that a few days afterward she began to vomit about twice a day, independent of her meals, and has continued to do so until the present time.

June 11th, the patient wished to be removed to her home in the country and was allowed to go. Her condition when she left the hospital was as follows: Suffering constant, and severe pain across the bridge of the nose, and in frontal region, for which morphia grain  $\frac{1}{4}$  is given p. r. n. Swelling in the nose perceptibly increasing, but no external evidence of the same. Eye symptoms are unchanged, except the vision is less in both eyes. Right vision is 20/100 and the left is 20/200. Has marked optic neuritis in both eyes. Patient's son reports weekly concerning his mother and says that she is failing rapidly.

I neglected to state that I had her physician examine her carefully for any evidence of tumor or symptoms of cancer in other parts of the body, but he reported negatively.

*The Pathological Report* of Dr. Anzinger is as follows: Mrs. G., May 19, 1905. Curettings from the inferior turbinated region. Microscopically, the general anatomical landmarks are wanting. One small fragment consists mainly of a delicate framework of connective tissue surrounding many closely arranged gland spaces. The gland spaces are irregular in shape and size, the basement membrane in general being intact, but in some instances distinctly broken, with atypical lining cells. The surface of the growth is largely covered with normal ciliated columnar epithelium, but in a few areas this is distinctly atypical, suggesting beginning malignancy. The remaining fragments of tissue consist of a stroma myxomatous in character, and with a rich supply of large spindle cells. Throughout this stroma are irregular islands and columns of cells closely arranged, simulating epithelioma. On closer analysis these cells have large irregular nuclei with scant protoplasm. A few cells are multi-nuclear. The blood vessels and spaces are embryonic and largely made up of these same cells. In a few areas the cells are arranged in whorls and strands, giving the appearances of spindle cell sarcoma. The tissue containing these cell groups is free from gland spaces and pavement epithelium, it probably represents curettings from the deeper strata of the turbinated body.

*Diagnosis:* Sarcoma (spindle cell?) of the turbinated bone with adenoma carcinomatosum of the mucus glands and superficial carcinomatous proliferation of the surface epithelium.

Case IV. T. C. D., painter, age sixty-four referred to me in consultation; the diagnosis of sarcoma of the septum having been made.

*Family History:* Grandparents on both sides died after eighty years, but does not know the cause of death or duration of illness. Father died at age of seventy-three of "Paralysis of the brain." Mother died at age of seventy-three of the same cause. Two brothers living in good health, ages seventy-two and fifty-seven. Two sisters; one living; in good health; age fifty-six. One died at the age of fifty-five from Typhoid. No near relatives, uncles, aunts and cousins included, have ever had tuberculosis, cancer or apoplexy.

*Personal History:* Patient has had all the ordinary diseases of childhood. Had malaria four or five times between the ages of twenty and forty. Has been a painter for the last thirty years, but for the last fourteen has worked in a shop, polishing filler from road rollers, which is a very dusty occupation, the workman being enveloped in a cloud of dust all day long. For the last five years patient has had catarrh as evidenced by frequent "cold in the head."

*Present Trouble:* Thanksgiving Day, 1904, his head began to ache and has continued to ache ever since. The nose was stopped up on the right side. In February, 1905, he noticed a lump on the right side of the nose externally, on a line with the lower orbital margin, not painful. From February 15th, to March 13th, right cheek was swollen and right eye was almost swollen shut, and with a profuse discharge from the eyelids. He consulted a physician who diagnosed polypi narium and abscess of antrum of Highmore. On attempting to remove the polypi with cold wire snare the doctor was compelled to discontinue his operation on account of the profuse hemorrhage. The small piece taken out was given to the pathologist for microscopical examination, and poultices were applied to the cheek. After four days the antrum was opened through the canine fossa with a scalpel. The opening has discharged some pus ever since. The nose has remained about the same as far as the patient is able to judge.

*Status praesens:* Right nose is filled with a dull greyish colored cauliflower-like mass, which bleeds freely when touched. Has perforation of septum in its anterior at the junction of the osseus and cartilaginous portion with edges heaped up, soft, and bleeding freely when disturbed. The left nose is free except around the edges of the perforation. Has an opening into the antrum in the canine fossa from which pus oozes and through which a probe passes freely in all directions.

There is no external swelling of the nose and no tenderness on pressure. Transillumination shows the right antrum dark and the frontal sinus dark on both sides. The right eye is congested and oedematous. Complains of slight frontal headache, inability to breathe through the right side of his nose and frequent bleeding of nose from slightest provocation, but never very alarming.

A small piece of the growth was removed for microscopical examination, and the patient was sent to the hospital. He was given potassium iodide and protiodide of mercury for several days without any result. The growth in the nose gradually increased in size until May 29th, when patient was given a general anaesthetic with the idea of doing a radical operation, but after curetting away the whole interior of the nose and finding the accessory cavities involved, the operation was discontinued. Hemorrhage was profuse but readily controlled by use of post-nasal packing applied before the operation was started and by anterior packing applied at the completion of it.

Patient recovered promptly from the operation, and was sent home ten days afterwards (June 7th), in a very comfortable condition. He returned every second day for inspection. He was seen last by me on June 12th when he said that he felt good except for a slight headache. Remarked that his appetite was better than it had been for some time, and that his bowels were regular. On June 13th he went to the hospital in the morning and after dinner came up town from his home a distance of about three squares, to see a parade. He returned home about five p. m. tired, but after a hearty supper felt rested. After supper on the way to toilet he had a violent hemorrhage from the bowels. At 11 p. m. he had another, but soon retired and was asleep. The patient was found dead the next morning at 4 a. m., sitting on the vessel. There was about a quart of blood in the vessel. The patient had evidently died from exhaustion due to intestinal hemorrhage.

*The Post-Mortem Findings* as given me by Dr. F. P. Anzinger are here reported in full:

"Autopsy on T. C. D., June 14th, 1905, at 3:30 p. m. Body of slender build, moderately emaciated, rigor mortis throughout. Body has been embalmed. The subject has an old ankylosed deformity of spine which makes the left shoulder girdle more prominent. The right malar region is slightly more prominent than the left, and a slight transverse incision is noted below the inner canthus of the right eye. The abdomen is moderately distended. The subject has a heavy dark grizzled moustache. The hair on the scalp is scant, and with a bald forehead. No visible scars or deformities on the body. The scalp is thin and easily removed. The skull cap is likewise thin and shows no anomalies. The brain is hardened by the undertaker's fluid, but otherwise negative. The vessels of the cerebrum, especially the circle of Willis, are very thin and almost transparent. The base of the skull shows no pathological changes. With a blunt curette the cribriform plate is broken through exposing the nasal sinuses which are filled with an offensive grumous material which in all probability is new growth. The probe is easily passed into the various sinuses, into the right antrum of Highmore, also into the right orbital cavity. From the antrum the probe is passed forward through the outer wall of the superior maxilla pushing the skin before it. The posterior part of the septum is entirely necrosed.

An incision is made from the sternal notch to the pubes. The skin is thin and the panniculus scant, consisting of golden yellow

fat. On opening the abdomen the distended colon presents itself, and is deeply injected. Explorations of the loops of the small intestine shows the same injection of the walls, especially scattered along the ileum. The appendix is normal. The caecum and colon are filled with a few jelly blood clots and blood stained slimy mucus. The intestines are opened throughout, and carefully explored. In the lower part of the ileum is felt an indurated mass involving the intestinal wall, the lumen corresponding to this region contains a firm jelly clot. On closer examination the induration is found to be circular about the size of a half dollar. The mucosa is smooth and shiny, the muscularis is displaced by a vascular and homogenous tissue, which is either new growth or an infectious granuloma. The mucosa at this point is displaced by a rough granular surface, the same containing a few pin-head size blood vessel openings. The caecum and nearly the whole length of the colon has the mucosa markedly injected and in places slightly eroded. The stomach is moderately injected. The pyloric opening is quite narrow (artifact), but otherwise negative. The undertakers fluid makes the examination of the tissues difficult.

The liver is very much enlarged. The lower third of the right lobe is furrowed by the pressure of the lower ribs. The liver surface is roughened but not nodular. No new growths are seen on section. The gross appearance is altered by undertaker's fluid.

The gall bladder is much elongated and sausage shaped, being 8 cms. in length and 3 cms. in diameter. It is filled compactly with gall stones. On opening the gall bladder the walls appear slightly thickened, and the mucosa in many places eroded. The gall stones, numbering 170, are practically uniform in size, polyhedral in shape, dark greenish-brown in color, and of the consistency of chalk. The cystic and common ducts are patent and show no pathological changes.

The spleen is about twice the normal size, flattened and rounded in contour and contains two shallow notches. Its structure is altered by undertaker's fluid.

The pancreas is slightly enlarged, especially the head end, and many of the lobules are atrophied and replaced by golden yellow fat.

The kidneys are both normal in size, with uneven surfaces. On section, the cortex and medulla appear atrophied and the pyramids are surrounded by fat tissue. The fibrous capsule is moderately adherent. The fatty capsule is very thick and made up of golden



yellow fat. The adrenals are represented by ribbon-like, pale, chocolate-brown bodies embedded in golden yellow fat. On section, the right adrenal contains an area of pale yellow and white mottling which may be new growth.

The mesentery contains a moderate amount of golden yellow fat, embedded in which are found enlarged lymph nodes. The nodes on section appear honeycombed, probably due to infiltration of new growth. The retroperitoneal nodes show similar changes.

The abdominal aorta appears normal but was not opened.

The urinary bladder appears normal externally.

Chest: The costal cartilages are ossified throughout. The mediastinal fat is abundant. Both lungs are air containing, and show moderate anthracosis. The right lung is firmly adherent throughout, due to an old adhesive pleuritis. The left lung is slightly adherent posteriorly, but is otherwise negative.

The heart is moderately enlarged and contains a heavy deposit of golden yellow fat. It was not opened by request.

*Microscopical Findings:* Curettings from the right nares consist of new growth. The tissue is made up of polymorphous cells, irregular in size, the nuclei atypical and hyperchromatic, and the connective tissue scant. Giant cells are very few in number. The blood spaces are very abundant and made up of tumor cells. The specimen represents a polymorphous cell sarcoma.

The indurated wall in the ileum consists almost entirely of new growth, closely resembling the primary growth in the nose. A few remnants of the muscularis are made out and the mucosa is entirely displaced by tumor cells which are necrotic. The blood vessels are very numerous being entirely made up of tumor cells, many of which lead up and open into the lumen of the intestine. (This explains the cause of the hemorrhage.) The remainder of the intestinal tract shows catarrhal enteritis with small cell infiltration in the submucosa and atrophy of the mucosal glands.

The cardia of the stomach shows marked fibrillar degeneration of the muscularis and a few areas not unlike sarcoma, are seen in the intermuscular stroma.

The mucosa shows moderate chronic hypertrophic gastritis.

The sphincter of the pylorus: The muscularis shows changes similar to those found in the cardia. In the cellular tissue between the two layers of muscle is found a small vessel the walls of which are made up of sarcoma cells resembling the primary growth. The mucosa appears normal.

The spleen: The capsula is thickened. Large bands of trabeculi are noted but in general the stroma is not increased. The follicles are atrophied. A few diffuse small areas of secondary sarcoma are seen. The spleen shows chronic congestion.

The pancreas: The parenchyma shows beginning necrosis. (Postmortem change?) Areas of Langerhans are closely arranged, a few undersized and a few hypertrophic. The parenchyma is largely atrophic and displaced by adipose tissue.

The liver: The lobular arrangement is very indistinct. The liver cells in some areas show granular and fatty degeneration. Fatty infiltration is only slight. The liver cells are largely atrophic but a few areas show compensating hypertrophy. Glisson's capsule is moderately increased. Scattered throughout the liver stroma are found islands of sarcoma cells which stain deeply and contrast strongly with the surrounding tissue.

The gall bladder: The wall is moderately thickened, the muscularis is largely displaced by loose edematous connective tissue. The connective tissue stroma composing the submucosa appears embryonic in character. The mucosa is largely displaced by a smooth modified connective tissue containing a few remnants of gland tubes.

The lungs: Show marked emphysema, moderate anthracosis and chronic adhesive pleuritis. No new growth found.

The kidneys: The capsule is thickened. The stroma is diffusely increased strongly resembling beginning sarcoma. These appearances are however unlike the primary and are not to be considered as secondary new growth. The parenchyma shows early cloudy swelling, many obliterated glomeruli and a few cysts.

The mesenteric glands: The tissue consists almost entirely of sarcoma surrounded by a capsule of adipose tissue. These appearances represent secondary infiltration.

The adrenals: The mottled area spoken of above proves to be an adenomatous change in the parenchyma. The parenchyma is atrophic in areas. The stroma is increased and has changes embryonic in character and not unlike beginning sarcoma. No secondary sarcomatous areas found. The adrenals show marked congestion of pigmentation.

The question of malignancy in any part of the anatomy always brings up the discussion of the etiology. Whether to accept Conheim's theory or the parasitic one or to evolve some new theory entirely, is one of individual choice. We can, however, agree upon

one point, and that is that we are not all a unit on any one theory. Outside of the theoretical side of the question the disputed point of how much a factor is irritation in the cause of malignancy, especially in the nose, is a much discussed one. The first two cases in my report show distinctly the transition stage between a benign and a malignant growth. Was this change brought about by trauma or by irritation produced by repeated operations is difficult to decide. I believe, although I can not prove it, the operations did cause the change. Watson accounts for the change by believing that since tissues of the same type may change from one to the other (Metaplasia), that we can have, arguing from the same basis, changes from a benign to a malignant growth. Since we know that myxomatous tissue is the lowest grade of connective tissue, and does undergo many and varied changes, why is it not reasonable to suppose that it may change from benign to malignant. Olney in a most excellent article on "Chronic irritation in the etiology of carcinoma" concludes that "Chronic irritation, mechanical or chemical, produces a cellular proliferation sometimes giving rise to a papilloma or adenoma, and sometimes, when the resistance of the opposing tissues is slighter or the irritation longer continued, to a typical carcinoma." All are agreed I believe, that we do have areas of malignancy in benign growths. How much influence trauma or irritation has on producing malignancy can be better worked out from the study of those parts that are more exposed to trauma, and especially in which malignancy is much more common than it is in the nose, viz. os uteri, female breast, the lip, stomach and gall bladder. After it has been proven that trauma does or does not have any influence in those areas then we can more accurately judge of its influence in the nose where the condition is so comparatively rare. Johnston in his article believes that trauma does not have any influence for in the majority of the cases reviewed by him there was no history of injury, that is, of external injury. I take it, however, that injury under discussion does not mean external violence, but rather the slight irritations that come to the mucous membrane either from operations, friction of polypi or pressure from same, or the irritation produced by a chronic discharge. The etiology seems after all to hinge upon a something called predisposition.

I would be however, of the opinion that all cases of clinically diagnosed polypi which return very soon after radical removal should have a very thorough microscopical examination, irrespective of heredity, symptoms subjective or objective (especially epistaxis), which might point to malignancy.

In respect to the question of heredity we can not come to any definite conclusions. If there is a clear history of cancer in the family we accept it as the result of inherited predisposition; but if there is no such history then we have no positive evidence to the contrary for the reason that the patient may not be informed as to the exact nature of the disease which caused the different members of his family to pass away, or perhaps the physician himself is not quite clear as to the cause of death, and if not permitted to make an autopsy he and the family are forever in the dark. For example, in the last case here reported, had the patient died from hemorrhage of the bowels before his nasal condition had been recognized and no autopsy had been allowed, the death certificate would have been signed "hemorrhage from the bowels" and his descendants would never have given a history of malignancy in their family. I take it that such a condition is not at all far-fetched, hence any negative history of malignancy is in no way conclusive evidence of its non-existence.

In conclusion, permit me to say that I think one should report in full every case of malignancy in the nose that comes under observation, so that in time we may have a wealth of material from which to draw conclusions instead of the few reported cases we now have. About sixty authentic cases of carcinoma, and about one hundred and fifty of sarcoma have been reported. The great majority of these reports, however, are so meagre that it is impossible to arrive at any accurate conclusion. And, further, in all cases that have been reported cured, if there has been a return of the malignancy, the same should be reported in full, with such additional data as there may be, giving the date and place of reference of the first report.

#### ADDENDUM.

While the above report of cases was being read, the patient reported as Case III died on the morning of September 17th, from exhaustion due to inability to swallow for the last three weeks. The report of the autopsy conducted by F. P. Anzinger and J. C. Easton follows:

*Autopsy* on Mrs. G., at 9.30 a. m., September 18th, 1905: Body of short build. Chest large and rounded. The skin well nourished, Panniculus large in amount but soft and flabby. The face appears slightly emaciated but is symmetrical. No swelling or induration noted. Hair moderate in amount and grizzled. Muscles small and soft. Rigor mortis throughout. Hypostasis in pendant parts. (Body has been embalmed.)

Head: The scalp is negative. The skull cap is thick throughout. The dura is distended with fluid. The brain is removed *en mass*. On external inspection, it shows no evidence of new growth. The vessels composing the Circle of Willis are very thin and parchment like. The cranial nerves appear normal. The base of the skull, corresponding to the body of the sphenoid, is replaced by a soft, white, slightly nodular growth. This growth replaces completely the Sella Tursica, the Basilar process, the Wings of the Sphenoid and farther forward the Hard Palate. All of this tissue is removed *en mass*. On section it is soft and in places gritty. The bony framework is entirely destroyed. The cut surface appears uniformly greyish-white, with very little evidence of organization. The frontal sinus is patent and free from pus and new growth. The ethmoidal cells and the right Antrum of Highmore are filled with an offensive purulent detritus. A probe is passed forward through the antrum and the tip may be felt anteriorly under the skin. The maxillary bone is disintegrated. The orbital cavities are intact, and on opening with a chisel the soft tissues appear practically normal.

Thorax and Abdomen: Panniculus golden yellow, very soft and oily. Cartilages of ribs completely ossified. Intestines appear normal. Liver appears normal, and is free from visible secondary growths. The Pancreas is negative. The Spleen has a few whitish nodules on the surface, otherwise negative (new growth?).

The Kidneys and Adrenals show no gross pathological changes. The Stomach is of normal size and appearance. Uterus and its appendages show senile changes. The Heart is of normal size and appearance. The Lungs are free and air containing. No enlarged glands or secondary growths found in the thorax or abdomen. (A description of the more subtle pathological changes in the viscera is impossible owing to changes induced by undertaker's fluid).

*Microscopic examination* of post mortem tissue: Growth in Sphenoid body. Typical picture of small spindle cell sarcoma. A few remnants of decalcified bone tissue are found. (This growth is probably primary.)

Spleen: The capsule is thickened, the stroma shows congestion and atrophy of the follicles. A few small hyaline area are noted near the surface. No new growth.

Liver: Moderate fatty degeneration and infiltration. Increased hematoidin pigment in the intralobular zone.

Kidneys: Atrophy of the stroma, slight cystic changes near the surface, beginning cloudy swelling and congestion.

Adrenals: Normal.

Pancreas: Moderate fatty infiltration between the lobules.

Heart: The muscle shows moderate fatty degeneration.

Uterus and Ovaries: Senile fibrosis.

Brain and Cord: No pathological changes noted.

Optic Nerves: Both show congestion and slight oedema. The right nerve within the orbital cavity shows slight infiltration of new growth in the loose cellular tissue surrounding the sheath.

*Diagnosis:* Small spindle cell sarcoma of the sphenoid bone. (Primary?) Sarcomatous infiltration of the Ethmoidal cells, the Antrum of Highmore and the Hard Palate. Microscopic infiltration of new growth in the right optic nerve sheath. Slight atrophy, congestion and hyaline degeneration of the spleen. Moderate fatty degeneration and infiltration of the liver. Slight atrophy, cystic change and early cloudy swelling in the kidneys. Moderate fatty infiltration in the Pancreas. Slight fatty degeneration of the Heart muscle. Senile changes in the Uterus and its appendages.

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#### DISCUSSION.

DR. BECK: There is a great deal that may be said about this paper, but at the same time in discussion I would simply say it is a very clean report. I have studied the clinical report, I have studied the paper and the microscopical sections which were sent to me about a month ago; and I find that, according to the labeling of the slides and the report, they correspond, that the diagnoses are correct. I wish to say, however, that on that point there is a great deal of discussion, and particularly Kyle calls our attention to the indeterminate diagnosis in scrapings of the nose in sarcoma. When there is some difficulty in making a diagnosis histologically between syphilis and sarcoma by simply examining scrapings, it is necessary to remove a sufficient part of the tissue and make a satisfactory slide. Dr. Minor's sections were certainly large enough to enable one to tell that the condition was sarcomatous and carcinoma.

As to the result of the treatment in these cases, it is too early to say that they are cured. If one takes a case like Price Brown's recently reported after several years, having reported it three or four years ago and again the other day, and which he reports as still remaining cured, such a report is of some value. But in these cases the time is too short.

The post mortem examinations which were made in this case were of some value, and add to the clinical value of the reports:

I would like to add in connection with the treatment, post operative treatment, in cases of sarcoma, tuberculoma, infectious granuloma of all kinds where malignancy is suspected, that we are able to use the ray treatment, the X-ray or other method of treatment in stopping or preventing the recurrence of the growth. I am quite anxious to see what theory they have here in Buffalo in connection with radio therapy so far as the intra-nasal disease is concerned.

In this connection, I take the privilege of reporting a case of sarcoma of the nose, that Dr. Ballenger referred to me for treatment with radium. He had operated originally by the mouth, but later by turning down the nose, making a cross incision across the bridge of the nose and thoroughly cleaning out the intra-nasal cavity of pure sarcoma. Following this operation, I used the radium intra-nasally with the satisfactory result that a year has passed and there is not the slightest trace of recurrence of sarcoma.

This is, of course, not unique. It is reported by others and Dr. Freudenthal was to have told us something about it this morning. I am sure he has cases of a similar kind.

DR. MAYER: It does seem as though we should draw the line between the four cases presented, two cases of ordinary myxomatous polypi undergoing probable changes, while the other two were cases of undoubted malignant disease. It is important this should be done for the reason that the literature becomes rapidly burdened with reports of cases of malignant disease not absolutely substantiated, and for that reason I call attention to this particular point. That ordinary myxomatous polypi may undergo these changes has been demonstrated more than once. I presented some time ago a case of myxomatous polypi where it was impossible to do anything short of a radical operation. In this case I made an incision along side of the nose through the upper lip and drew the nose to one side and removed a mass of myxomatous polypi large enough to fill an ordinary Mason jar. The examination showed in this case, similar to the



first case here recorded, that we had myxomatous polypi undergoing malignant degeneration.

DR. BROWN: I might add a report to show the fatal termination, and its rapidity, in a case of sarcoma of the antrum. The case was brought to the hospital during my service there with a history of pain in the eye and over the antrum of Highmore. The case had been observed just two weeks before and was brought to the hospital. There were marked exophthalmus of the left eye and considerable swelling over the antrum. The diagnosis was made of sarcoma. A radical operation was performed; the superior maxilla was partly excised, taking out one-half. The operation seemed to give almost immediate relief from pain to the eye: but at the end of two weeks, during which time the patient remained in the hospital, there was a recurrence. The eye again bulged out and there was practically no hope. The girl went home and died in about two weeks, giving the length of life of about six weeks after the disease was first noticed.

DR. SPOHN: Mr. Chairman, the paper was very interesting to me. I have seen quite a number of those cases; and all the cases operated upon died soon after the operation. I can not understand why physicians persist in operating upon these malignant growths, when they know the patient is going to die very soon afterward. The general rule is they die much earlier if they are operated upon than if they are let alone. I have observed frequently where the X-ray was used before operation and soon after operation, that the results were just the same as those given by Dr. Beck. I have been using the X-ray on a number of cases, not only in the face but in other regions of the body also, with the most excellent results. If the X-ray is used a short time before operation until the system is under the influence so to speak of the X-ray or whatever its action is on the general system, and then after the operation we get some results. No one can tell what the future will be in these cases; but some of them have gone two and three years, without recurrence.

To repeat: I cannot understand why a surgeon should want to disfigure the face, when he knows his patient will die soon, and an operation will only shorten life. I think it is a wrong position for physicians to take.

DR. STEIN: This paper unquestionably opens a most interesting field for discussion. It is probably beyond our time. But the question of malignancy in the nose is without a doubt of immense

interest, particularly when it comes to paying something for such a case. I am particularly struck by the divergence of opinion that exists between rhinologists as to the method of procedure to be resorted to. There seems to be a tendency nowadays, more or less, to radical treatment in performing operations, particularly as practiced by the general surgeon. The rhinologist tries to confine himself as much as possible to intra-nasal work, which is of course proper if it can be done to the satisfaction of the patient. When I was in Toronto a few days ago, I had the privilege of seeing the two cases of Dr. Price Brown referred to by Dr. Beck. I was in his office and saw one of them while there. One of them had been operated upon and presented before the American Laryngological Society. The case had been reported there I think a few years before. This young man he told me, and the young man substantiated it in my presence, presented all the typical facial deformities of a marked case of malignant growth of the nose, the exophthalmos, the frog face, the pressure on the palate, complete occlusion of the left nostril and other such obstructive signs. I looked into the young man's nose and examined him very carefully and I was surprised to see what a wonderful result Dr. Brown had obtained by this method that he is so enthusiastic about, and which is well known, that of ignipuncture with the electric cautery. It is true this case at present shows a constant recurrence. There is a small sized recurrence about the origin of the Eustachian tube on the left side. It is very small. The Doctor very kindly operated while I was there, and I saw him introduce his electric cautery six or eight times into this mass; and he says the following day he has the patient come in, and he removes the slough, and the patient has no inconvenience whatsoever. In fact, he has never been inconvenienced from his work more than one day. At one time he had a hemorrhage in his office after the operation, but at no other time has he been inconvenienced at all. The Doctor has had this case under observation for four years. Now, that is a really remarkable result from such a procedure.

The other case he has is one that has been living for ten years and shows no signs of recurrence whatsoever. If we can attain such results by such measures, ignipuncture or some similar method, certainly it seems far preferable to the more radical surgical procedure. If I mistake not, Dr. Loeb, our president, treats such growths by intra-nasal operations, by a process of morcellation or picking out or gouging out as much of the tissue as he can and he

gets no bad results; at any rate, no deforming results, and his patients seem to live longer than those operated upon more radically.

DR. MINOR closing: I think that my position will be more clearly defined by finishing the reading of my paper. The object in presenting the first two cases was to bring up the point of a change from a benign to a malignant growth. I believe that such changes can and do occur.

In reference to the criticism in operating on cases of malignancy, I do not believe that any one would operate on a patient *in extremis*, but I feel we are fully justified in operating to relieve from the intense suffering although we know that we can not arrest the development of the disease.

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## SOME OBSERVATIONS ON THE FOSSÆ OF ROSENMÜLLER.

BY THOMAS L. BRUNK, B.S., M.D., DECATUR, ILL.

In March, 1901, a young married woman, Mrs. A. E., aged 22, came to me for treatment of what I diagnosed as hay fever, in which I found both middle turbinates wedged tightly between the Septum and outer walls, a slight deviation of the Septum to the left, and a small posterior hypertrophy. I also found both ears had suppurated leaving both drum membranes adherent to the internal walls of the tympanic cavities.

I removed both middle turbinates and the posterior hypertrophy. This together with a course of medicine directed to the kidneys and to what seemed to be a chronic bronchial trouble, improved her condition very much; so much that in the course of a couple of months I discharged her. In about six months she returned with a hoarseness, which she had had at first, so increased that she scarcely spoke above a whisper. Her nose was in an almost ideal condition and her tonsils were not inflamed nor enlarged. The vocal cords were hyperemic, but there was no lesion in the larynx to which such a symptom could be referred. There was, however, a chronic pharyngitis with the characteristic enlarged glands studded over the oro-pharyngeal wall. I had made an examination of the naso-pharyngeal space when she first came to me and had observed two very strange-looking broad flat plates, of what I mistook for an anomalous growth of bone in the vault, reaching from the upper margin of the fossa of Rosenmüller and the posterior edge of the eminence about the Eustachian tube across the vault to the upper edge of the vomer. The two flat plates from the two sides left a V-shaped space between them, showing the true vault above.

Since I was somewhat puzzled as to the cause of such deep hoarseness with no recent coryza to aggravate it, I proceeded to re-examine the naso-pharynx to see if a cause could be found. I looked at those peculiar bands again, and determined to introduce the index finger and see if they were bony, as they appeared in the mirror. To my surprise, they were found to be adhesive bands that were easily torn asunder with the finger. I followed up the bands into the fossa of Rosenmüller, and again was almost amazed

to find that the finger sank into a soft granular mass that completely filled both fossæ. It bled freely for about a minute after I curetted them out with the finger. When the bleeding ceased I gave the fossa an application of silver nitrate, grains forty to the ounce, on a long bent applicator, through the mouth.

Such chronic granular inflammatory tissue is an irritant wherever found in the system, and I concluded it had something to do with this severe hoarseness. To my delight when she returned in three days for another application of the nitrate of silver, her voice had greatly improved. After five applications of the nitrate of silver, each time followed with a five per cent solution of campho-menthol in alboline to take away the offensive taste made by the nitrate, the fossæ were quite free from the old granular tissue and adhesive bands. The voice in the course of a month became about normal.

The next case is that of a married woman, Mrs. C. D. C., aged 32, who came to me for the relief of a "sore spot" in the left side of the larynx and slight deafness. There was nothing in the larynx to cause such a sore spot. Nose and tonsils were normal. By post-rhinoscopic examination, I found adhesive bands stretching across the whole length of the fossæ of Rosenmüller with but little inflammatory coloring of the mucosa. It was very deceiving to the eye. The granular matter stored beneath these bands was not to be seen. There was nothing striking about the view to cause one to believe he had seen much of anything that would form the basis of an etiological factor in certain reflex and inflammatory troubles.

Not finding any other cause for her symptoms, I decided to introduce the index finger and break up the adhesive bands. The fossæ proved to be full of the soft granular tissue beneath a bridge of bands. The patient said she could hear the bands snap as they broke off. Silver nitrate was also applied on a cotton applicator and campho-menthol in alboline sprayed into the naso-pharynx and the treatment was complete. In four days the patient called again for another application of the silver nitrate. By that time her throat symptom was gone, and in the course of a couple of months her drum membranes were assuming their original lustre. During this time pneumatic massage and catheterization were given both ears about three times per week.

These two causes encouraged me to watch for these diseased fossæ in other cases complaining of certain reflex symptoms, which I gradually found could be referred to them as the cause. The

results have been so flattering, and in a few cases so nearly magical that it seemed best to present them to this meeting.

Before referring to a number of other cases where the peculiar symptoms will be stated, I wish to discuss this important etiological factor in the naso-pharynx that has been overlooked by other observers and omitted in our text books and literature.

The anatomical relation of the fossæ of Rosenmüller to the Eustachian tubes, and the nose, pharynx and larynx give to them the most commanding position as a first cause in producing secondary inflammation in all these related parts. I have had two cases where the nasal fossæ were large enough to watch the swallowing act and see how it effects the fossæ of Rosenmüller. In both cases, the posterior and internal margin of the fossæ approached and met the posterior margin of the Eustachian eminence. This, to my mind, gave me a clew as to the formation of the granular inflammatory tissue and adhesive bands in the fossæ. I have also in a few cases found the eminence of the Eustachian tubes so large and somewhat swollen that they projected backward into the fossæ impinging upon the back wall of each fossa. In one case I found the cheesy, putrid masses so often found in infected tonsils, lodged in the fossæ where they evidently were formed. All this lead me to conclude that here is a primary point of inflammation due to contact of two mucous surfaces constantly impinging by the action of certain muscles in the parts, or by anatomical deformity, as is found to be the first great cause in the nasal fossæ. In several cases I observed that the oropharyngeal wall stood at a considerable angle to a perpendicular plane that stands at right angles to the median plane of the body. This diagonal position extended up into the naso-pharynx causing one fossa to be much narrower than its fellow. In such cases the narrow one was always found to be filled with inflammatory granular tissue and often nearly occluded by adhesive bands. I found, too, that the ear on the side having the greater amount of inflammatory tissue in the fossa was affected in some way more than its fellow. In fact, I now look at the drums first to determine whether the fossæ of Rosenmüller are at fault as the cause. Take a patient that has not noticed that the hearing has been reduced, and if the fossæ are loaded up with the granular tissue, the drum will have the ground-glass appearance, be somewhat retracted, and the light-reflex partially gone. This to me is a sure indication that the fossæ are filled and need the simple operation I have mentioned.

In all cases of otitis media due to infection, I am led to believe that the primary cause lies in a diseased fossa of Rosenmüller. It

being so close to the mouth of the Eustachian tube, infectious microbes easily gain entrance to the middle ear from such a rich culture media as that found in the inflamed recesses of the fossæ.

In fact, I never feel now that I have done my duty in treating acute or chronic otitis media if I have neglected to free these fossæ of their long accumulated granular tissue. The operation depletes the tissues surrounding the mouth of the Eustachian tube, and removes the harboring place for the offending bacteria.

Authorities state that acute otitis media is often caused by colds. This is true, but why is it that only one ear becomes affected in so many cases. I have found that the affected ear is always associated with a badly diseased fossæ of Rosenmüller, which seems to be the real seat of first infection; and this infection and greater inflammation due to the presence of the coryza is carried up to the adjacent tube.

The literature on the fossæ of Rosenmüller is so meager that it is scarcely worth while to quote from it. Bosworth (1) mentions the fossa, once where he describes it as follows: "This fossa varies somewhat in depth in different subjects, although it is usually elongated, and much broader above than below, and is mainly of interest in that in introducing a Eustachian catheter, its point is usually engaged in this depression."

I have thought that it is a mistake to drag the end of a Eustachian catheter over the diseased fossa before placing it in the entrance of the Eustachian canal. Unless the fossa is first curetted out, we are likely to pick up an infection and introduce it into the canal which may prove disastrous to our treatment. We surely should carefully examine these fossæ before placing a catheter in them.

Dench (2) just mentions the fossæ of Rosenmüller once in telling how to find the mouth of the Eustachian tube; he says: "Behind this we observe the fossa of Rosenmüller." He makes no mention of any diseased condition of the fossæ or of its relation to other diseases or reflex symptoms. In speaking of the cause of acute salpingitis he says: "The chief predisposing cause is some obstructive lesion of the nose or naso-pharynx. The presence of adenoid vegetations is a particularly potent factor in its causation. The presence of this soft tissue in the vault of the pharynx affords lodgement to pathogenic bacteria, from which locality they easily find their way into the canal." Here he states the exact philosophy of the cause, but it applies to the fossæ of Rosenmüller far more often than to adenoid tissue in the vault.

Bishop (3) does not mention a word about the fossæ, though he refers to a plate showing one. He does say significantly under etiology of acute otitis media, "This affection most often results from a cold in the head, and may be caused by inflammation of any portion of the upper respiratory tract and by eruptive fevers."

I am of the opinion that the cause of eruptive fevers having such bad sequelæ in some ears and not in others is due to the fact that these fossæ in the bad cases are full of this granular tissue before the fever begins, which gives the microbe producing the eruptive fever an easy foothold and also holds the infection close to the mouth of the Eustachian tube.

Shurly (4) merely mentions the location of these fossæ, but does not say a word about any pathological condition found in them. In speaking of the causes of chronic pharyngitis, he mentions hereditary predisposition and stomach troubles as the principal ones, but also says that authorities do not agree as to the real cause. "Therefore," he says, "the etiology is rather obscure." My observation is that chronic pharyngitis is a positive sign of some lesion in the nose or the naso-pharynx, and in obscure cases the fossæ of Rosenmüller will always be found diseased. To my mind treating this disease on the oro-pharyngeal wall and not treating these or any lesion in the nose is far from scientific, and will always be barren of good results.

Wright (5) in his recent book does not mention the fossæ of Rosenmüller. Under chronic naso-pharyngitis, he names the whole list of causes familiar to us all, but never once refers to the polypoid growths and adhesive bands, found in these fossæ in every case of chronic inflammation of the naso-pharynx.

Barr (6) says the predisposing cause of purulent otitis media is especially adenoid vegetation, but does not mention the specific cause found in these fossæ. In fact, all the writers I have examined are rather indefinite in stating the etiology of otitis media both acute and chronic.

Another writer (7) in referring to treatment of middle ear disease prefers to remove "slight adenoids situated around the orifice of the Eustachian tubes." It seems that many writers find adenoid growths scattered all about the naso-pharynx. I have found enlarged glands on the posterior margin of the Eustachian eminence as large as half a small bean and about the same shape, but never adenoid growth in any place but the vault of that space. Trautman contends that adenoid vegetations never have their origin in



Rosenmüller's groove in the immediate neighborhood of the tubal ostium. B. Frankel, Shaffer and others have contended that such origin is frequently found.

Pierce (8) of Chicago refers to a cut which, he claims, shows adenoid growth growing directly from the Rosenmüller groove.

From my observation, there may be found enlarged single glands that look and feel like those on the oro-pharyngeal wall, but filling the fossæ outside of these glands is a true granulation tissue that is very soft, vascular and easily removed by the index finger. It is not adenoid tissue. Adenoid tissue is far tougher and more resistant.

I might say here, in operating on these fossæ, the operator should stand behind the patient with the thumb of the left hand on the teeth of the lower jaw to hold the mouth wide open and prevent biting of the right index finger which is to be introduced. This finger is made sterile and introduced high up into the vault, then with a downward sweep with a side of the finger behind the Eustachian eminence the soft tissue is followed down below the eminence as far as it is to be found. The deepest portion of the fossa just behind the eminence should be gone over once or twice more till the bottom is reached. This should be done with guarded pressure, as it is a very tender region, as the writer has learned by doing this operation upon himself. Both fossæ can be curetted in a few moments before the finger is withdrawn.

I have devised a new curette which has not as yet been made, as I believe the best results are attained with the finger. The following are some of the more interesting cases I have had:

Dr. F. E. F., a dentist, aged 34, complained of having hoarseness quite frequently. He had no other lesion in the upper air passages aside from the granular masses, and adhesions in the two fossæ. After a finger curettement and treatment, his hoarseness left him in less than twenty-four hours and has not recurred.

W. O. S., a young man referred to me by Dr. Pierce of Earlville, Ill., complained of a lump in the throat for the past seven months. It seemed to him that it should be swallowed and he performed the act of swallowing quite often to get rid of it. Aside from the fact that the epiglottis stood at an angle of about 20 degrees to the posterior wall, and a slight infection of the small left tonsil, his throat was normal. The left fossæ contained large bands on the side where the "lump" was located. These bands and small amount of granular matter were removed and treated as in other cases and the "lump" disappeared.

Rev. E. C. B., aged 38, referred by Dr. Brewer of Shabbona, Ill., complained of his voice growing so tired toward the end of a sermon that it was an effort for him to continue. I found nothing in the upper air passages but the adhesive bands that could be the cause of such a trouble. They were removed with quite a mass of granular matter in the deep part of each fossæ. He reports that his voice has been much improved.

Miss L. J., aged 26, of Bessemer, Ala., came to me complaining that she had been to two other throat specialists, who had been unable by several treatments to stop a sore sensation in the neck below the left tonsil, and an occasional expectoration from the throat of small pieces of calcareous deposits. She had saved one of these small masses to show me. I treated it with hydrochloric acid and the effervescence showed it to be carbonate of lime. There was no indication about the tonsils that such a deposit could occur there. They, in fact, were very small and quite healthy. The fossæ did not show by post-rhinoscopic examination any special trouble, as they were healed over by adhesive bands almost completely. But on introducing the finger I was surprised to find both fossæ deep, narrow and filled with a more indurated mass of old granular tissue than we usually find. It took considerable pressure of the finger to get to the bottom. Both sides were curetted at one sitting. Nitrate of silver was applied. She noticed that the reflex sore sensation in the lower part of the throat was gone at once. It is now four months since the operation and one treatment given about four days after the operation is all that has been done during that time. The patient is much pleased over the result. She is not continually attempting to get something from her throat as she was before. This seems to be one of the most convincing cases I have had that showed the fossæ to be the true cause of the trouble, and the nearly magical result from so simple an operation. The diagnosis was really the main feature in the case.

Dr. R. C. Hanna, of Marion, Ala., a young man, came to me complaining of a "big lump" above the palate that he could not swallow. His nose and throat were quite normal, but his fossæ were large, deep and very full of this granular polypoid tissue. In removing it, there was considerable hemorrhage. But as soon as it was out, he said the "big lump" sensation was entirely gone. I gave him but one application of nitrate of silver, and he got so well that he never returned, even after earnest solicitation on my part to take a few more treatments.

H. Y. W., aged 52, sheriff of Perry County, Alabama, came to me with what he thought was a tendency to grow deaf. His hearing was but very little below normal. Left drum membrane somewhat retracted, lustreless, and light-reflex reduced. Right ear tube edematous and scaly. Both tubes were mopped out with yellow oxide ointment and thoroughly cleaned. Nose had a medium sized ridge impinging on the left inferior turbinate. He also rubbed his hand down both sides of his neck and said: "There is a peculiar sorish feeling there." The naso-pharynx was examined and the fossæ were both heavily loaded with bands and granular tissue. The ridge in the nose was removed at the first sitting. A month later the throat symptoms were the same as they were at first. I then emptied the fossæ of the granular matter, and found that on both sides this matter continued down from the fossa in a deep fold formed by the posterior pillars and the pharyngeal wall to about the base of each tonsil. There was considerable hemorrhage owing to the large surface of granular tissue curetted. This is the only case in which this granular matter extended beyond the fossæ. To my surprise the throat symptoms all disappeared and the hearing became perceptibly better. The drum membranes regained their lustre and general normal appearance in less than two months after the work on the fossæ.

These few cases taken from probably about two hundred in my practice will serve to show the symptoms and results of treating the fossæ of Rosenmuller.

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## TRANSILLUMINATION OF THE MASTOID.

By ALBERT H. ANDREWS, M. D., Chicago.

Examination of the mastoid by transillumination is based upon the fact that normal bone transmits light; while bone, the air cells of which are filled with pus or granulation tissue, obstructs the passage of light.

The test is made by means of a small cylindrical 12 candle power incandescent electric lamp covered with a soft rubber hood having a 5-16 inch aperture at the end for contact with the mastoid. The examination is conducted in a darkened room. An ordinary ear speculum is placed in the meatus and directed backward so as to expose the posterior wall of the auditory canal. The lamp is placed with the aperture against the back part of the mastoid and the light directed slightly forward. When the mastoid is healthy and its anatomic relations normal, the posterior wall of the auditory canal becomes luminous.

When the mastoid is filled with the pus or granulations no light is perceptible in the canal. These statements are based upon the examination of over two hundred mastoids. In thirty cases in which light was not transmitted, pathological changes in the mastoid were demonstrated by operation.

In a large number of chronic cases in which light was transmitted, local treatment such as cleansing and draining has brought about a cessation of the discharge. In no chronic case as yet which did not transmit light have I been able to stop the discharge by such means. Most of the cases operated upon were of the chronic type while a few were subacute. In two acute cases in which the mastoid did not transmit light operation revealed cells filled with pus. I have had a number of acute cases of otitis with mastoid symptoms which did not transmit light. As the cases recovered, however, transmission of light returned. I have not operated upon a typical case of osteosclerosis. In one case, that of a little girl of eleven with chronic suppuration; the outer part of the mastoid was eburnated, but in this case the lateral sinus was very superficial and lay only 3-16 of an inch behind the auditory canal. I am unable to say whether it was the eburnated mastoid or the lateral sinus or both which interfered with the passage of light. It is certain that veins throw a shadow. This can be demonstrated by passing the

light through the tissue between the proximal ends of the first set of phalanges. The shadow of the superficial veins coming from the fingers can be seen with great distinctness.

In some of the healthy cases which transmitted little light, it is probable that the lateral sinus may have had some influence as auscultation indicated that the sinus was located unusually far forward. The degree of illumination varies in different healthy cases. The density of the mastoid, the position of the sinus and the amount of pigment in the skin and deeper tissues are probably the determining factors. In the examination of a number of negroes, little light was transmitted while the greatest illumination noticed was in the case of an anemic blond.

The lamp I have used is made by Hardy & Co. although the Beck combined heater and transilluminator is very satisfactory. I do not know who designed the Hardy lamp as it seems to have been of gradual development. It has certain defects which in time will probably be overcome. One of these defects is the excessive heat it generates when used without a rheostat. Because of this, it is a good plan to use the light by intermittent flashes rather than by continuous illumination. I have used the lamp for transilluminating the frontal sinus and for the maxillary antrum. In the former, it gives excellent results; while in the latter when the bare lamp is used the results have not been all that could be desired. The light is so intense and is given off from so great an area that shadows are not clearly defined and the shadow of moderate opacities has been entirely overlooked. In reporting the following cases only the pertinent features of each is given.

CASE 1. Hazel H., a girl 11 years of age, had suffered from left acute otitis media three months before coming to Chicago. For two weeks there had been no discharge, but there had been an uneasy feeling in the side of the head, with some dizziness. Temperature 100 degrees, pulse 90. Examination of the membrane showed that the perforation had closed. There was some bulging of the posterior superior wall of the canal. Some tenderness on pressure, but no perceptible swelling or edema over the mastoid. No light could be made to pass through the mastoid and a diagnosis of subacute mastoid abscess was recorded. At operation the next day, July 18th, at the Woman's Hospital, the mastoid entirely to the tip was found filled with pus and granulation tissue.

CASE 2. Dr. A., age 28, had left acute otitis media six weeks. Upon examination, May 2, 1905, the soft tissue over the mastoid

was found to be slightly edematous and somewhat sensitive to pressure. There was slight discharge coming from a moderate sized perforation in the drum membrane. As in the former case no light was transmitted through the mastoid. The case was operated upon May 3rd. When the outer table of the mastoid was removed granulation tissue and pus welled up into the wound and showed well marked pulsations. In clearing out the mastoid the lateral sinus and dura were found to be exposed over an area 1-2 by 3-4 of an inch.

CASE 3. A young lady, 24 years of age. Chronic suppuration of left ear since childhood. No tenderness or swelling in region of mastoid. The drum membrane was gone and a foul smelling discharge was present. In transilluminating the mastoid, light was found to pass through fairly well; but since necrotic bone could be felt in the attic and antrum an operation was advised. In operating May 3rd, open superficial mastoid cells were found, but the antrum was filled with granulation tissue and the walls of the antrum were necrotic. This is the only case I have operated upon in which light was transmitted; but the healthy condition of the superficial part of the mastoid undoubtedly accounts for it, and the findings in the case give additional proof of the reliability of the test.

CASE 4. B. S. A lady 24 years of age. Chronic suppuration since childhood. In examining with the probe, a sinus was found just external to the membrana tympani leading back into the mastoid. The discharge from the sinus was offensive and the probe came in contact with necrotic bone. No swelling and no tenderness over mastoid. In using the transilluminator no light passed through the affected side, while the opposite mastoid transmitted light freely. In operating, the usual amount of pus and granulation tissue was found extending to the outer table.

The case to which this method of examination seems most applicable are those of chronic and subacute type. In all cases of suspected mastoid disease which do not have the usual external symptoms, whether the cases are acute, subacute or chronic, every method of examination which can possibly aid in determining the condition of the interior of the mastoid should be employed. While transillumination has its limitations, that it will frequently render valuable aid in the diagnosis of such cases, and that it has sufficient diagnostic value to justify its use becoming general, the writer is firmly convinced.

## SOME DISPLEASING RESULTS IN MASTOID OPERATIONS.

BY J. A. STUCKY, M.D., LEXINGTON, KY.

No apology is offered for bringing this subject before this Society for discussion, being composed of the younger as well as the matured members of the profession, who are devoting special time and energy to Otology. This organization, as its name implies, carries with it the idea that every member is, or is supposed to be, an investigator or student of this branch of the Science and Art of Medicine.

The observations herein considered are those based upon one hundred and twenty-eight operations upon the Mastoid, only fifteen of which were the radical or Stacke-Swartz. Few operators obtain ideal results in the majority of instances, and the failures and displeasing results are the ones that call for study and discussion.

Probably the last word has been said regarding the necessity for the immediate surgical obliteration of the mastoid cells when invaded by suppurative infection, and the recent number of classical articles as to the method and technique of doing this leave nothing to add. Notwithstanding this, there are still those who believe in waiting for external evidence of pus formation before resorting to the operation. Then there are those who simply evacuate the cellular structure by making free opening through the cortex, and the larger number who believe in the thorough obliteration of the entire process when once infected. Whiting's recent classical work has done much toward clearing up many of the disputed points in the modern mastoid operation, but there is still much to learn, and the need for our deciding, once for all: 1. What are the pathognomonic symptoms of infection of the mastoid cells? 2. When is the best time to resort to surgical interference in both the acute and chronic form? 3. The best preparation of the patient for the operation. 4. The best after-treatment that yields most rapid and satisfactory results. The exchange of opinions regarding these points will be profitable to us all, especially to the younger members who live in the smaller cities, remote from the great medical centers of learning.

It is astonishing how few general practitioners appreciate the necessity of giving special attention to their patients with ear

trouble, equally so, how few appreciate the vast difference between the so-called classical and radical operation. Within the past few months, I have had one of our leading practitioners tell me that the result of mastoid disease in its deceptiveness and destructiveness was a shocking revelation to him, the cause of this remark being the result of his having brought to me for a myringotomy a patient with a spasmodic ear-ache which kept him awake at night for a week or more. This case was one of the most extensively diseased mastoids I have ever seen, with large epidural abscess, with no external evidence of pus formation, and I could not convince him that swelling, temperature, pulse and fluctuation were not the chief indications for surgical interference. It was with difficulty I persuaded him to consent to my opening the mastoid as well as incising the drum membrane. The result, to use his own language, "was a shocking revelation."

The rapid advance made in Otology in the last few years, the deceptive and destructive results of the invasion of la grippe, make it necessary for the Otologist to labor patiently and persistently with the general practitioners until we accomplish what the abdominal surgeon has done regarding appendicitis, in making them see the importance of recognizing the first symptoms and knowing just what treatment to use.

Barnhill says: "In many acute cases, the most unpleasant sequela of the mastoid operation has been the extension of the necrotic process to such a degree as to require subsequent curettement, or often a secondary operation after the wound had apparently healed."

In some chronic cases where the radical operation has been performed, and the nature of the wound was such that skin grafting could not be done, the healing process has been both prolonged and tedious.

McKernon: In some cases a sagging of the posterior wall of the fibro-cartilaginous canal has resulted, diminishing the antero-posterior diameter near the orifice, and is due to an unnecessary separation of the periosteal lining from the posterior wall of the bony canal in making sure of the spine of Henle, rather than to failure to properly pack the canal with gauze in the early post-operative dressings."

J. W. Murphy (Cincinnati): "Granulations in the attic and narrowest place where the wedge of bone has been removed, have given much annoyance, occasionally atresia of the external auditory canal. Both of these results have been due to faulty packing of the



cavity. A failure to eradicate all diseased bone in a chronic case sometimes results in a suppurating sinus which refuses to heal, unless the wound is reopened and the necrosed bone thoroughly curetted."

Chevalier Jackson: "Following the radical mastoid operation, I have had no permanent facial paralysis or other displeasing sequela save failure to cure the discharge in five per cent of the cases. Reoperation reduced this to two per cent. Following the modified Swartze operation in acute cases, I have had two cases of facial palsy from neuritis: one case coming on in forty-eight hours, in the other seventy-two hours after the operation. One of these cases was a traumatic mastoiditis with fracture from a blow by a base ball. A large sequestrum lifted off the vertical portion of the facial, leaving a centimeter of the nerve exposed in the wound. I have now a case of fistula occurring six months after healing. There are tubercle bacilli in the pus, but I am confident the condition is curable by a radical operation."

Ballenger mentions (1) granulations or proud flesh overcome by sterile dressings, instruments and hands, (2) continued or prolonged discharge overcome by (a) the total ablation of all cells in mastoid zygomatic root, etc., (b) finishing the operation with hand burr to render the bone cavity smooth. This facilitates speedy epidermization of the wound. A rough bone wound retards the healing process.

The foregoing quotations from personal letters from a number of Otologists represent a fair average of the observations and results obtained. Nothing is said of the unsightly scar, and no deaths reported except in cases where meningitis had begun before operating, the operation being performed as a last resort.

In my own cases, 128 in number, forty per cent of them had nearly all of the external evidences of pus. Five of these were of the Bezold variety and the pus had burrowed down into the neck under the Sterno-cleido-mastoid muscle. In nine others the abscess had ruptured or been opened by the attending physician and the sequestrum of the cortex had sloughed out of the wound, leaving the vitality of the soft parts so much impaired that much of it had to be removed, making healing by granulation a necessity. These resulted in ugly scars, some of them being remedied by plastic operations.

Some atresia of the canal was the result in three cases, due to faulty packing and neglect of after-treatment. Facial paralysis due to neuritis in three cases, one following a second operation for

osteo-myelitis, one in which vertical portion of the canal was destroyed by the disease leaving the nerve exposed, in the third case the nerve was injured by too forcible use of the curette during the operation. All of these completely recovered in from two to four months.

In the fifteen radical or Stacke-Swartz operations, the results have been all that could be desired, except that in five cases obstinate granulations and lowered vitality prolonged the after-treatment to an annoying and discouraging degree to both patients and myself. In all of these cases has the hearing been improved by the operations, and I have had no fatalities. One of the most surprising after-results has been in the improvement in the general health of the patients, especially in the chronic cases. I have operated upon only five acute cases, cases in which there had been no previous pain or suppuration in the ear, the majority being those of acute exacerbation upon chronic condition.

To those of us who live in cities not so large but that almost daily we meet on the streets some of the living monuments of the pleasing and displeasing results of our efforts, our successes or failures, these questions become of more than passing interest, especially if it be one of those cases in which for days or weeks, one eye never completely closes even in slumber, and one side of the face never responds with a smile. Next to these, are those with the unsightly scar, or the ever-present piece of gauze and plaster covering an unhealed wound.

Fortunately injury to the facial nerve does not often occur; and with greater care, improvement in technique, except in grossly anomalous conditions, or as a result of prolonged suppuration in which the canal is eroded, the nerve exposed, and neuritis a secondary result, paralysis will become less frequent.

Undoubtedly one of the most frequent and deplorable causes of many of the displeasing sequelae, is due to neglect in urging the operation early, as soon as reasonably assured suppurative infection has extended to the antrum and cells, instead of waiting until the disease has completely invaded and infected, the contiguous structures, and the resistive and recuperative power of the patient undermined by the absorption of the retained septic material.

Emphasis should be made that it is just as dangerous to wait for external evidence of pus formation in the mastoid process as it is in the abdomen in appendicitis. We often confront a condition where the conditions demanding operative interference are as ob-

scure and as difficult to interpret as those found in an involvement of the appendix.

Another cause of displeasing after-effects, especially slow recovery, elevation of temperature or post-operative fever, has been an insufficient and inefficient preparation of the patient before the operation. The modern mastoid operation, especially the radical or Stacke-Swartz, is to be classed with the major surgery of to-day, and aside from the conditions existing calling for the operation, we must consider the time required to do a clean, complete operation, the age and condition of the patient, particularly with respect to the nervous system. Nearly every case is more or less septic as shown by the blood count, the vitality is far from normal, and to this condition we are to add the results of the anaesthetic plus the operation itself. Most of my earlier cases presented evidence calling for immediate operation, and only a few hours were allowed for preparation. Those cases where indican was present in the urine, were followed by more or less high temperature and recovery was slow. The result followed in nearly every case where time was not taken before the operation to thoroughly cleanse the alimentary canal and administer at least two tub baths. This cannot be done in less than twenty-four hours, and more time should be given unless the symptoms are urgent. Mild starvation, free purgation, and thorough bathing, followed by brisk rubbing of the entire body, are the best preparations for a rapid and pleasing recovery.

It must be remembered that in septic conditions, food not assimilated thoroughly, is a derangement of the body chemistry. Fermentation and putrifaction go on. Ordinary bowel movement may remove some of this, but peristalsis is imperfect and much of this decayed mass remains behind in the folds and pockets of the canal. The shock caused by the anaesthetic and operation combined, so lowers the already crippled vitality and so impairs elimination and resistive ability, that toxins are absorbed into the circulation giving rise often to alarming symptoms, the alimentary canal furnishing a culture medium for germs that produce toxins which may speedily so paralyze the vital centers that even death may ensue.

Prolonged lithemia also furnishes conditions for the easy and rapid development of sepsis.

H. A. Houghton (*Medical Record*, May 27, 1905) reports "thirty cases of minor infection following different operations, in nearly all of which a toxemia of intestinal origin was present. In 27 out of 30 cases, he found indican in abnormal quantities in

the urine. The practical application of the conclusions means attention to the proteid fermentation taking place in the bowel, particularly in those cases in which the urine presents a large amount of indican. It is not sufficient simply to produce evacuation of the bowels. The indicanuria must be treated by diet and other procedures looking toward complete cessation."

I have seen, both in my own work and that of my colleagues, slow and unsatisfactory recovery follow a very thorough and complete operation so frequently where intestinal toxemia existed, as evidenced by the excess of indican in the urine, that I regard it as a important factor and one that must be guarded against.

The most thorough and complete eradication of all infected cells, both of the mastoid process and zygomatic roots, and in the radical operation all diseased surface in the middle ear, remnants of the membrani tympani and orifice of the Eustachian tube—the bone wound must not only be left clean, but smooth; this lessens the tendency to formation of granulation tissue and hastens epidermization.

The last, and by no means the least important factor in causing some displeasing after-effects, is the carelessness and indifference shown in the after-dressing of the wound, and in the diet and quietude of the patient for several days immediately after the operation.

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## A NEW INSTRUMENT FOR MASTOID SURGERY.

BY W. SOHIER BRYANT, A.M., M.D., NEW YORK.

After much experimenting, this instrument has been selected from a long series of tools used by the wood carvers as the one which could add something useful to the armamentarium of the aural surgeon.

The instruments which have been much in vogue in mastoid work are the drill (now rarely used), the chisel and gouge, the curette and the rongeur. But the chisel and gouge and curette leave something to be desired in their usefulness. The chisel and gouge require to be driven by a mallet, the blows of which cannot but be detrimental to the patient's central nervous system. These instruments also occasionally slip, especially when in the hands of the less



Front Bent Gouge.

experienced, inflicting unfortunate injuries, while the curette makes extremely slow progress in hard bone.

My front-bent gouge seems to overcome these deficiencies. This instrument saves time over the curette when working in dense bone, thereby shortening the duration of the operation and conserving the strength of the patient. It removes bone more safely than the chisel or gouge, at the same time relieving the patient of the objectionable mallet blows on the head, which materially hastens the convalescence, while at the same time it relieves the mind of the operator to no small degree by the reduction of the danger of an unfortunate accident or wounding the vital parts by the slipping of the instrument. The more extensive and difficult the operation the more this gouge demonstrates its usefulness.

The importance of shortening the duration of the operation cannot be overestimated, and in this respect alone the new instrument de-

serves the preference over the others. This is especially the case where there is sclerosis of the mastoid process. Here the instrument enables the operator to proceed rapidly and without fear of the risk of opening the sinus. The danger of slipping through the dura mater is reduced to a minimum, because the force applied is never parallel to the direction of the excavation, but at right angles to it. Nor is the cutting edge of the instrument sufficiently sharp to cut the soft tissues; it glides over them and thus avoids any danger of wounding the dura mater or venous sinuses. This gouge enables the operator to cut fearlessly through the outer table of the mastoid process without dread of cutting the sigmoid sinus. Even in extremely irregular positions accidental injury to the sigmoid sinus is avoided. The work can proceed so rapidly that, instead of occupying one and a half hours or more, a difficult radical operation can be completed in three-quarters of an hour or less.

Of no less moment is the advantage which the instrument affords in point of certainty and safety of action when working on the inner parts situated close to the labyrinth. By its slow and easily guided motion the cutting blade trims with the greatest accuracy. In the radical operation the facial nerve is avoided, even in a bleeding wound. This constitutes one of its greatest advantages over the chisel method, in which accidental injury to the facial nerve is unfortunately a matter of occasional occurrence.

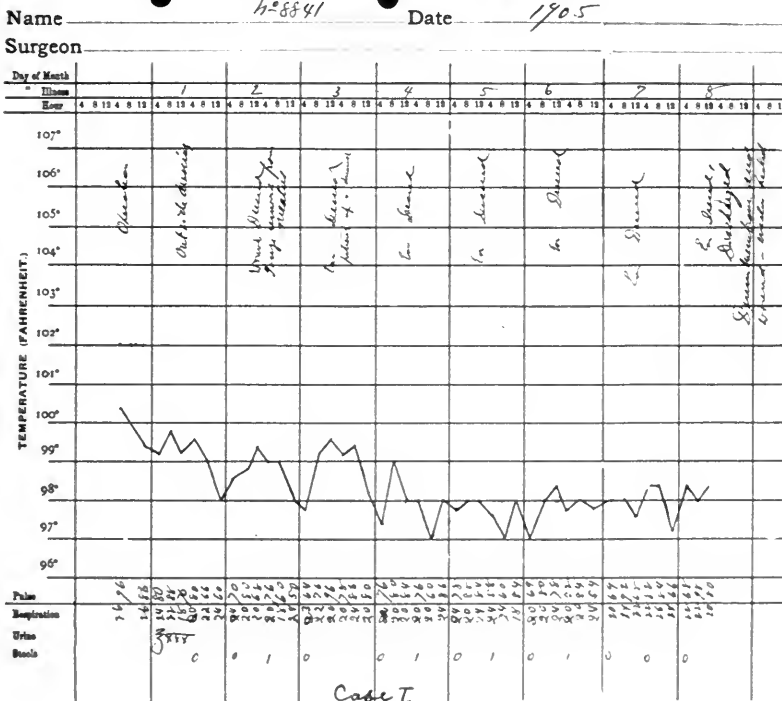
An advantage of this gouge over the ordinary gouge or chisel, aside from the question of avoidance of danger, consists in the fact that the chisel has to be driven into the bone with a mallet; and there can be no doubt that these hammer-blows, be they comparatively gentle and repeated, or hard and few, have a certain, although indefinite, harmful and retarding action upon the convalescence of the patient. I use the new instrument in all my operations and am confident that it actually shortens the period of convalescence by four to five days. I have observed cases in which the instrument was not used that required from two to five days, or more, to recover from the immediate effects of the operation, whereas in cases operated upon with the front-bent gouge it is rare for patients to show any discomfort after the operation.

As compared with the curette, the advantage of the new instrument lies chiefly in its stronger action. For this reason it will often displace that instrument to advantage when bone has to be removed which, on account of its hardness, offers too much resistance for the curette. Finally, it is especially useful in the removal

of the upper and lower ends of the annulus tympanicus when this is cut during the radical operation.

This instrument lowers the operating risk a noticeable amount, which may justify earlier operation. Moreover, in remote country districts, where no specialist is available, the general surgeon (if he be otherwise skilled in the handling of instruments) might be entrusted with the management of this gouge, while with only the

### NEW YORK EYE AND EAR INFIRMARY.



older instruments he might well shrink from the ordeal of a mastoid operation.

That the duration of the operation and the length of convalescence are shortened by the use of the gouge is shown by the following cases.

*Case I.* A boy 17 years old. Otorrhoea six weeks, large swelling above and behind ear. Mastoid process and all the cellular bone

found disintegrated. It was all removed together with three-quarters of the posterior osseous meatus and the outer wall of the epi-tympanic space preserving the annulus tympanicus and ossicles in-

## NEW YORK EYE AND EAR INFIRMARY.

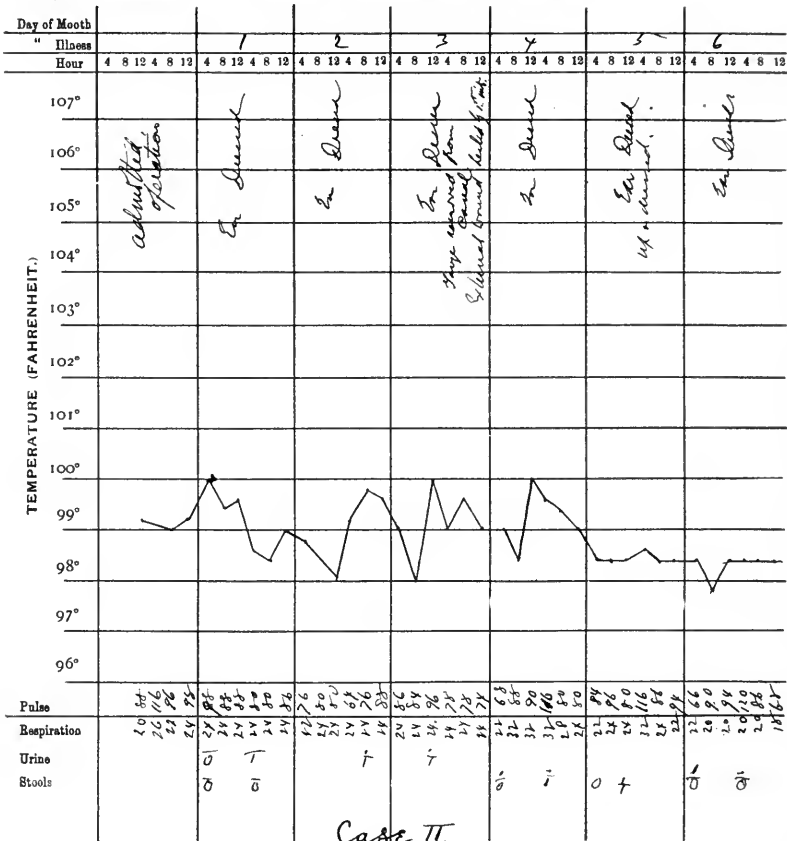
Name

No 9017

Date

1905

Surgeon



tact. The dura mater was uncovered in both middle and posterior cranial fossae. Wound closed; gauze in canal. Operation lasted 28 minutes. 2d day, removed gauze from canal. 3d day, patient up. 8th day, went home with membrana tympani and meatus healed



and external wound closed by first intention. 16th day, watch  $\frac{13}{60}$  (inches). 21st day, all scabs off. 34th day, watch  $\frac{15}{60}$  (inches). Has had no pain since operation.

*Case II.* A girl 16 years old. Discharging ear 10 years ago after measles. One year previous to the operation the ear began to discharge again. Two weeks previous to the operation she had two days of pain. Headache on the same side as the sore ear and dizziness for a week. At time of operation, no discharge. Patient very hysterical.

The mastoid antrum had been drilled some years previously. Our operation consisted in converting the antrum, epi-tympanic space and tympanum proper into one large cavity, after removing the posterior wall and the hanging wall of the meatus. Operation lasted forty minutes. Patient showed no signs of discomfort after the operation. Wound closed; gauze in meatus. 3d day, took packing from meatus. External wound had healed by first intention. 5th day, patient up and dressed. 29th day, middle ear epi-dermatized and permanently dry.

The method of using the front-bent gouge is at once simple, safe, and decisive. In beginning an operation for the perforation of the outer table of the mastoid process, the instrument is used like a drill, swinging on its own longitudinal axis. As the excavation of the bone proceeds, the instrument is swung around in a large circle, until finally, as the opening grows larger still, the instrument cuts the edges of the perforation, the curved portion of the blade resting on the edge of the bone which serves as a fulcrum, while the cutting edge takes off shavings from the neighboring lip.

In case the excavation approaches the dura mater, the latter will naturally be uncovered. If the onward course of the gouge were now continued in the original direction, the pressure of the hand would plunge it through the dura, but at this juncture the direction is changed and the cutting edge is applied directly to the edge of the bone lying upon the dura which can be removed without any danger or injury.

As the instrument proceeds to the deeper portions, the gouge should be used only as a lever, the adjacent bone serving as the fulcrum on which the convex part of the blade rests. In this way the handle can be swung with considerable force and great accuracy, cutting off large or small fragments, as necessity and conditions indicate.

As soon as the opening in the outer table is sufficiently enlarged, the application of the ronguer is substituted for that of the gouge, while the curette is used to remove any soft structure within.

In summarizing the advantages which the front-bent gouge embodies, as compared with the instruments previously in use, I believe I may justly lay claim to the achievement of the three points I laid stress upon at the beginning, namely, increased speed, increased safety and better care of the patient. The time occupied by the operation is lessened by about one-half, especially if the bone be sclerosed. There is the powerful action which gives it the unquestioned preference over the curette, at the same time obviating the application of blows from the mallet. There is also an absence of risk of accidental injuries, owing to the positive control which the operator at all times exercises over the conduct of the instrument, which enables even surgeons not necessarily specialists to undertake an operation from which they otherwise would shrink. In consequence of all these improvements there is increased incentive to operate in doubtful cases.

The shortened time of the operation will redound to the benefit of the patient's condition, and the absence of hammer-blows and their effects upon the brain will hasten his convalescence.

It will be seen, therefore, that the front-bent gouge has many advantages and none of the disadvantages which are inseparably connected with one or the other of the older instruments. This being so, I hope this instrument will be received and generally adopted by all who have at heart the perfection of aural surgery and the welfare of their patients.

57 W. 53d.

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## A CONTRIBUTION TO THE TREATMENT OF THE DISEASED ATTIC.

BY F. C. HOTZ, M.D., CHICAGO.

Among the indications for the radical operation, the stubbornness of the aural discharge occupies a prominent place. The advocates of this operation think it should be resorted to if the treatment of a chronic otorrhea does not yield any decided results within three months. This is a very elastic and untrustworthy indication; for there is no uniformity in the treatment of chronic otorrheas and where one method has failed it cannot be said that another treatment might not have been successful. I am convinced that under this indication the radical operation is often performed when it could have been avoided.

Let me relate a few observations in support of my opinion. Last summer I witnessed a radical operation in an European ear clinic. It was a case of a moderate otorrhea of four years duration, which had been treated with negative results by a country physician during the last six months. Although the aurist admitted that he knew nothing about the ability and the treatment of the physician who had treated the case, he decided at once upon the radical operation because the case had been treated six months and the otorrhea was not cured! The operation disclosed an absolutely healthy mastoid, a clean and perfectly healthy antrum and only a mass of granulations in the attic, the bony walls of which were perfectly sound; and so were also the walls of the tympanic cavity. Was it necessary, I ask, in this case to chop away the mastoid, the posterior wall of the meatus and the aditus to remove these granulations from the attic? Was it not a hasty and unwarranted decision to operate for the simple reason that the case had not been improved by the treatment of somebody?

Two years ago a very strange thing happened to me. Within two weeks I was consulted by three patients who had been treated by the same aurist and were urgently advised to submit to the radical operation because the condition of their ears had not improved under his treatment. In the one case the operation was to be performed on the next day. In this case as well as in the other two cases there were no head symptoms nor any evidence of mastoid involvement during the entire course of the disease. The membrana tympani

was destroyed, malleus and incus absent, the walls of the tympanic cavity were smooth and pale, no caries or necrosis; only a moderate discharge of an inoffensive mucus evidently coming down from the attic. And this space was filled with soft, easily bleeding granulations. Asked for my opinion as to the necessity of an operation I said I did not approve of it, because I considered the disease curable without it. The first case was cured in four weeks, the second in six weeks; the third patient did not return. It interested me, of course, to find out something about the treatment upon the failure of which the aurist had based his urgent advice for the operation. And this is what I learned: The patients were told to syringe the ears every morning and to drop in some solution; once in three weeks they went to the doctor who—they told me—did nothing but look into the ear and told them to continue the same treatment.

Could anything but negative results be expected from such treatment? Indeed, I know no more indifferent treatment this aurist could have employed if he intended to demonstrate to his patients the uselessness of any treatment and to gain a plausible pretext to recommend the radical operation. For success in the treatment of chronic otorrheas depends chiefly and pre-eminently on the careful personal attention the aurist gives to his cases. This applies with particular force to those cases in which the attic is the source of the persistent discharge. Here the home treatment by syringing, gauze drains and the instillations of this or that solution is absolutely valueless; the injections do not wash out the attic, the gauze strips do not drain it and the solutions dropped into the external meatus do not reach it. But even if the medicines we can intrust to the patients reached the attic they would be inert because they are ineffective on granulations, polyps, cholesteatomatous masses and caries, the morbid conditions usually found in chronic attic affections.

These conditions must be attacked directly and this can be done successfully only with instruments in the hands of an expert. The necessary instruments are: 1. A fine silver probe the end of which can be bent short to any angle so that we can palpate with it any point of the walls and the roof of the attic: 2. Applicators of the pattern here shown made of sterling silver, the handle corrugated so that the lightest touch of the fingers can control its movements. The stem measures  $2\frac{1}{2}$  inches and ends in a cork screw spiral  $\frac{3}{4}$  inch long, around which cotton can be wound securely and yet can be taken off very easily. The spiral can be bent like the probe to any suitable angle so that medicines can be carried by it to

any point of the attic. 3. Small spoons like cataract spoons made of the same material and with the same handle and stem as the applicators. As the edges of these spoons are not sharp but smooth, inspissated matter and cholesteatomatous masses can be scooped out without any possible injury to the lining membrane of the attic. 4. An attic syringe for washing out the attic after the scooping operation. 5. Small steel curettes with a flexible stem of



Silver Probe.



Silver Applicator.



Blunt Silver Spoons.



Sharp Steel Curettes.

malleable iron so that they can be set at the desired angle for scraping carious walls or removing large granulation buttons.

To treat the diseased attic successfully we must of course gain free access to it. If there is only a small fistulous opening in Shrapnell's membrane this must be sufficiently enlarged by excising a portion of that membrane; but the removal of the osseous margin is not necessary. If the malleus and incus are still present and necrosed they should be removed at once. The attic can then be thoroughly explored with the probe to ascertain its condition. For the removal of cholesteatomatous masses we use the silver spoons. The work is done more thoroughly and rapidly than with the attic syringe the

current of which is not strong enough to dislodge firmly impacted masses. The syringe is used only for the final washing out.

Large granulation buttons and polyps are cut off with the curette. The presence of small granulations which cannot be seen directly can be detected and their site located by means of the applicator. As they bleed very easily the cotton wound around the spiral of the applicator becomes blood-stained when it rubs over such granulations; if we pass the spiral straight up to the roof and on withdrawing it find blood on the tip of the cotton we know there are granulations at the roof; if the concave side of the spiral is blood stained we know granulations cover the attic surface of Shrapnell's membrane and the adjoining osseous margin. In the same way we can ascertain the presence or absence of granulations at the anterior or posterior wall. The granulations thus located can then be treated directly. For this purpose a little cotton is tightly wound around the spiral and dipped in deliquesced chromic acid; the spiral is given the proper bend so that when passed into the attic it brings the chromic acid in direct contact with the granulations. Under these applications repeated every two or three days the granulations quickly disappear and often the discharge ceases with their disappearance. If it continues, or we have to deal with a chronic discharge without granulations from the beginning or after the removal of cholesteatomatous masses we possess in the flexible applicator an excellent instrument to apply directly and thoroughly over the whole diseased lining protargol, silver nitrate, camphoroxol or whatever medicine in our judgment is called for by the condition of the attic.

If this treatment is carried out religiously attic diseases do not prove as rebellious as they are generally believed to be. To be sure it takes a great deal of time for the patient to attend regularly to this treatment; but who would not be willing to make this sacrifice rather than to submit to a formidable operation which leaves an ugly disfigurement, requires a long time for the after treatment, and after all does not always insure a permanent cure?

34 Washington St.

DISCUSSION OF PAPERS OF DRS. ANDREWS, STUCKY, BRYANT AND HOTZ.

DR. BALLENGER, Chicago, Ill.: The whole question, to my mind, embraced in Dr. Hotz' paper, in so far as I heard it (I did not hear all of it) is embodied in one proposition of what constitutes cure. It seems to me that question will have to be settled before we can

arrive at any clear conclusions as to our estimation of the comparative values of the methods of treatment that are in vogue, those that have been advanced by Dr. Hotz in this paper, and those held by other operators. I have seen cases that seemed to be cured for one, two or three years, that were not cured at all. They did not happen during that time to be infected, and therefore did not send forth suppurative secretions. During all that time, however, in some of these cases there was undoubtedly necrosis which was gradually extending, without suppurating infection. There came a time, when necrosis of the attic or of the antrum was extensive and the whole necrotic area, which was now enlarged, became infected, meningitis developed and death followed. I have known of three such cases under my own observation, in which I am thoroughly satisfied that that was about what happened. So that if a case is apparently cured it is not necessarily actually cured.

To my mind necrosis of bone tissue does not often disappear without surgical interference of a rather radical sort. I mean by that, that the necrotic area should ordinarily be inspected or be subjected to observation in order to be sure that the cure has occurred. I do not mean to say that cures cannot occur without actual visual observation. I have had cases in which there was no operation performed in which sequestra of bone were thrown off in the form of bone dust, that finally healed over and were thoroughly cured without operation, even to the extent that Dr. Hotz has recommended in this paper. But on the other hand, I have seen cases that seemed to be cured that were not cured and in which the patient subsequently died. So I have a little dread in these cases where I think there is necrosis, where there is evidence that there is bone necrosis, and I have a little dread of allowing the case to be dismissed as cured until I have actually observed the diseased area, and have subjected it to such operative interference as seemed wise on actual observation.

I will state, however, that Dr. Hotz' paper is certainly a decided encouragement to us to be slower in opening mastoids where we are sure that the necrosis is limited to the attic. According to my observation, however, in the cases that I have operated upon, it is rare that I find necrosis in the attic that I do not find associated necrosis in the antrum. Such cases, however, exist. But the majority of the cases that I have seen have had necrosis in the antrum when there was necrosis in the attic.

DR. STUCKY: Dr. Bryant's paper leaves very little for me to add. Anything that offers more accuracy and enables us to facilitate the operation upon the mastoid is worthy of our closest attention. I have investigated this instrument a little bit and tried it on some hard wood and am sufficiently pleased with its operation to try it at once. Dr. Bryant is a close observer. I should be willing to take his word for it. Anything he says I regard as about true. I shall take pleasure in trying this instrument.

DR. HOTZ: I have listened to Dr. Stucky's paper and I have come to the conclusion that I must be an exceptionally fortunate man, for among all the displeasing results enumerated by the essayist I have experienced none in my own practice. I have never lost a case among my mastoid operations; I have never had a facial paralysis, no persistent granulations, and all that sort of things. Now one of the reasons probably is that I must have been fortunate not to have got under my care very desperate cases with extensive caries, necrosis, destruction of the bones, to lead to such displeasing results under the best of care and skill of the operator. Another reason perhaps is, and the Doctor referred to that point, I have from the very beginning of my practical career, insisted upon early operation. In fact, I believe I was one of the first who advocated the early mastoid operation in acute suppurative otitis. Not to wait, as was the habit and the teaching of text books at that time—it was away back in the 70's—for the opening of the mastoid until serious threatening head symptoms set in. I followed the principle of the surgeons: Wherever there is pus give it an outlet as soon as possible so as to obviate its burrowing somewhere in a different direction from what you want it to.

The question that Dr. Stucky touched upon is only: When is the proper time? How early to operate? Now I think in acute cases, this can definitely be settled. Of course, we all know that in violent, acute, suppurative otitis media there is the mastoid involved, and it shows usually by the external symptoms of some swelling, some redness, some tenderness, but we also know that with the subsidence of the middle ear inflammation very frequently, in a majority of cases, the mastoiditis subsides and the symptoms disappear. But when the symptoms of otitis subside and the symptoms over the mastoid persist, we are entitled to perform the operation. And also, if the otitis goes on and the mastoid symptoms persist and the inflammation cannot be reduced by local treatment, it is no use to wait any longer.



The one instance in which I ran pretty close to a displeasing result was one of those cases in which the operation of the mastoid had been delayed too long. A woman contracted a violent otitis with mastoiditis; and although the doctors always talked about performing an operation, they did not do it. Finally they sent the patient up to Chicago to our hospital, and when she came there was an immense swelling and fluctuation over the mastoid. We put her right on the operating table and operated. An immense amount of foul pus was evacuated; the outer plate was partly destroyed by caries; and the mastoid bone was converted into a large cavity. Scooping out the soft granulations of the walls, all of a sudden a gush of venous blood came and I knew the sinus was opened. I plugged it, finished the operation and put on a dressing of iodoform gauze. The case in four or five days developed chills; but the mastoid wound showed a healthy action and apparently there was no evidence of pus retention anywhere. The woman developed a cough and pulmonary symptoms, from pyaemic affection evidently, and afterwards she was transferred to the surgical clinic on account of pyaemic inflammation of the knee joint, and a metastatic inflammation was also developed in the ankle joint. Wonderful to relate she survived and got well.

DR. BALDWIN: Just one point which may be of interest. This summer I saw a case of acute mastoiditis which was in all probability due to a non-erupted wisdom tooth. The patient was a woman 38 years old who had not erupted either of her lower third molars; and there was every evidence of acute mastoiditis. A dentist was called and there was no wisdom tooth found as the cause. After the acute symptoms subsided I investigated, cut down and found the tooth without any trouble, evacuated some pus and I am in hopes the tooth will come through and the ear give no more trouble.

DR. ROBERTSON: Dr. Stucky's persistent cases suggest that necrotic tissue still remains. That is an indication I should expect. If I had a case where the granulations persisted, I should be pretty sure that I had not removed all the necrotic tissue. A case came to my notice some time since with a very peculiar condition that I should like to mention at this place as one of the things that may happen following mastoid operation that we are not looking for. I operated upon a woman for mastoiditis, and thought I got all the tissue that should come away, and packed the wound with iodoform gauze. On the next day, the case developed an iodoform dermatitis which changed after one or two days into erysipelas. On consul-

tation with some of the dermatologists, the question was brought up whether a dermatitis set up by iodoform gauze could result in starting a streptococcus infection. The dermatologist I talked with thought it was very plausible. Referring to Dr. Hotz' paper I do not think we should decry any operative procedure on account of dilatory treatment by any one particular man. Granulation tissue without suppuration, we may have in a mucous membrane. But granulations with suppuration, especially this ropery clear discharge he speaks of in his paper, I never experienced without at least some necrosis. Sometimes it is only about the edge of the tympanic membrane, but there is always necrosis. In those cases it is always our duty to enlarge a perforation in the drum membrane; as the one treatment in all cases of granulations in any part of the body is simply a matter of drainage, and the gauze drain as we adjust it now, of course, does not reach into the attic. But we can put it in the attic if we wish. Years and years ago in the clinics of Europe, you will all remember those little plugs of iodoform gauze which they used to use in a little tuft for putting up into the attic. Nearly everybody has a little instrument for putting it there. I have had one for fifteen years. These plugs are inserted into the attic. The attic is nearly always necrotic; and in very many cases it is absolutely impossible to get up there unless you remove the superior part of the tympanic ring. It is not always necessary to have pus to have a bad mastoid. Especially is this true of tuberculous patients. You may not have any symptoms at all and still have a necrotic mastoid or a necrotic attic and it will not get well no matter what the treatment is or who the man is that treats it, with medications. It is the duty of every otologist to treat the attic in all cases of suppurative otitis because the lower part is not the part where the suppurative process is situated. It is in the attic itself. The most dangerous disease I know of next to the tubercular disease of the mastoid, is that sequella of the grip. In those cases we will have suppuration of the middle ear then cessation of symptoms with necrosis of the attic and mastoid cells. In the cases I have seen, the symptoms had already subsided, and all of a sudden broke out anew, and when the operation was performed you would find the whole or a large portion of the mastoid process was necrotic.

DR. FOSTER, Denver: We have had presented to us two very different sides of this question and I am inclined to think that many of us will be inclined to share Dr. Stucky's feeling in the matter. We are not warranted in feeling that we can have absolutely no

mishaps, if many mastoid operations are done. Notwithstanding the best of care and often the best of technique, we will sometimes have happenings that we do not want and do not look for. I do not have to go back very far to remember a case of facial erysipelas commencing the second day after operation, which tore open the wound and gave a great deal of trouble. Another case after apparent healing, on the twenty-second day after operation, developed a well marked facial paralysis. Fortunately this was due to a swelling near the angle of the jaw and pressure upon the facial nerve after it came out of the stylo-mastoid foramen. I don't know of any indication during the operation that should have warned me of the case or two that was followed by thrombus of the lateral sinus. These inclined me to doubt that all our cases are likely to go on to uneventful recovery. On the other hand when things go smooth they are certainly very smooth and the results are very gratifying.

As to the time of operation in acute cases, it is very well agreed that it should be early. Marked external symptoms are not necessary to make the diagnosis and to demand an operation, especially in cases where we find bulging of the posterior canal wall and intense pain which is not relieved. Dr. Andrews' stethoscope and transmitted light, I am sure, will help us still farther in advising for or against the operation. I am inclined to believe that the cases in which Dr. Hotz has had such eminent success in the chronic variety, must be attributable to the disease lying almost entirely in the ossicles, for I cannot conceive of this treatment curing a necrosis or caries of the antrum or wall of the tympanic cavity. It seems too that there is a possibility that, in some of these apparent cures where the patient leaves for any reason and returns in four or five months and says that there is no discharge, he is mistaken, and there has been and still is a very slight amount of purulent matter which constantly remains on the floor of the tympanum, not enough to flow out, but just enough secretion to equalize the evaporation.

One cannot help but feel the responsibility we assume when we insist upon a patient having a radical mastoid operation, for while the results are excellent in a tremendous majority of cases, yet they occasionally take a bad turn and leave us in doubt as to whether our advice in this special case was wise. Still we must assume this responsibility, for it is far more dangerous to let this chronic discharge and necrosed bone continue than it is to operate.

DR. STEIN: Any means, in my opinion that will aid in our diagnosis of ear diseases is worthy of our attention. The aids to diagnosis introduced by Dr. Andrews this afternoon are of great value in many cases. But like all such instruments they have a limited value, as stated by the essayist; and I refer now particularly to the trans-illuminating lamp. One of the limitations for the trans-illumination is where we have very little or no involvement of the mastoid process; but involvement of the middle ear and its accessory cavity, the antrum, sufficient to warrant a mastoid operation. We see such cases frequently and we operate upon them, and I have used the trans-illuminating instrument as a matter of routine in a good many of my cases, and have watched carefully for this sign of light transmission. I have noted in such cases as I have referred to just now, where there was no involvement of the mastoid but extensive involvement, as far as pus and granulations were concerned, of the middle ear, the attic of the middle ear and the antrum, that we should be somewhat deceived on account of the transmission of light into the auditory canal.

As to the auscultation method; at the time Dr. Andrews read his paper at Cincinnati, I believe I put on record a case in which I was deceived by this means or aid to diagnosis, owing to a large cavity quite deep in the mastoid process. In fact it involved the cells in the posterior part of the process, posterior to a plane of the digastric fossa. But the cortex of the mastoid was excessively thick so that when I auscultated, the sound duration was equal to that of the opposite side and within the range of normal conduction. I do not remember exactly what, but about 20 seconds, I think. I was interested in the instrument at that time and noted it particularly; and when I did open the mastoid I found this very thick cortex and thought probably I was going to find nothing but an eburnated mastoid, when suddenly I entered a very large abscess cavity, very deep down. In cases such as these two we are liable to be misled by these aids to our diagnosis.

The paper of Dr. Hotz I think was a very happy ending to the symposium of mastoid operations, because it puts a check somewhat upon a tendency to too radical work in many cases, particularly by some of our members who come here and whose work in this line has been rather limited and who become enthusiastic after hearing the papers read here in which the authors report cases numbering into the hundreds, and feel as if it were almost a duty on their part to return home immediately and do some mastoid work on the first indication.

I want to say a word in regard to Dr. Stucky's paper. I was particularly impressed with the statement he made about having forty per cent of his cases show such marked external manifestations of internal involvement of the mastoid. Although we all see that occasionally I do not think many of us see it to such an extent. To my mind it indicates a need for education in the State of Kentucky, both among the laity and the profession. (Laughter.)

DR. TIMBERMAN: I fancy that early in our career before we have had very much experience in radical mastoid operations that our estimation of a man is formed a good deal by his ability to operate. That is, we think a good deal of a man who can perform a mastoid operation. I know I felt that way, but after about ten years of practical experience in handling these cases, I have come to regard the man of some worth who can take up the after-treatment successfully. If I had to choose between a good operator and a man who was perhaps not so skillful in the operation, but who knew how to conduct the after-treatment, I would take the second man every time. I am sorry that this afternoon we have not had a little bit more of the actual technique of the after-treatment of these cases, because here is where we have our trouble. Grunert says: Let no one think that after the operation is done the after-course of the cases is easy. Our work has just begun. Our hard work has just begun. I must say that for myself, I have not had so many of these unfortunate sequelae that we have heard of here this afternoon. I have had some of them; but when I have had them, I have nearly always demonstrated to my own satisfaction, that I am myself to blame. For instance, if I have a case that suppurates for a long while, I think something is wrong with my after-treatment; and I have definitely demonstrated that to my own satisfaction. I leave my cases, as I suppose most of you do, three or four days before I make my first dressing. Immediately after the operation I swab out the whole ear and mastoid cavity with one to five hundred solution of mercury bi-chloride. The fourth day in making my first dressing, I generally have some odor, as I presume most of you have. That settles it then and there usually. There is only one class of exceptions to that in my own experience, and that is in those cases which are due to the lowered vitality of the parts; granulation is unfavorably progressing and needs more than the ordinary packing. I never use iodoform gauze except in cases of lowered vitality of the parts. Otherwise I pack them with gauze strips or small pieces of gauze wrung out in a one to five hundred solution of bi-

chloride, in other words I pack with bi-chloride gauze, and that will stop the suppuration if we have done our work well during the operation and gotten away with the necrotic tissues. Persistent granulations, persistent suppuration may be due to an oversight on the part of the operator in failing to eliminate or eradicate some little point of necrosis; or secondly, it may be due to the covering over a not entirely healthy part of bone by the granulation tissues and superficial necrosis going on under the new formed tissue. Or thirdly, we may overlook a little fibre of the gauze, which becoming embedded in the granulating tissue will later set up trouble, and we think then we have some bone necrosis, when in reality we have not.

DR. SHERMAN: When I left my home it was with the firm resolve that I should observe the senatorial custom of keeping silent on the occasion of my first visit to this Academy. But I should do too great violence to my feelings if I did not express my full appreciation of Dr. Hotz' position. I believe the radical operation of the mastoid is entirely unwarranted in the great majority of cases that are operated upon. I believe that the first duty of the operator is to recognize that it is his purpose to remove all the debris of the middle ear in these cases of chronic suppuration. I believe the object in the greater number of cases of otitis media suppurativa with which we have to deal, is to prevent an extension of that disease to the mastoid. I believe the great mass of mastoid complications, is the result of neglect or faulty technique on the part of the operator. I have had no difficulty in the large number of cases that I have been called to operate upon, to find in the armamentarium of the dentist, instruments admirably adapted to the curettage of the middle ear. I have never permitted myself to operate on the mastoid unless it was a condition of last resort. I have had many of these cases to deal with. When I have operated upon them, I have met with fatal results. I have opened the sinus; I have had facial paralysis; I have had all the complications that anybody has had, and I regard myself fairly skillful as an operator; but we all know there are anomalous conditions which are entirely beyond the power of any man to recognize. The great difficulty in curetting the middle ear is that one cannot curette the anterior wall. To obviate that difficulty, I take a small chisel which I find among the dental instruments, and cut away that triangular section of bone permitting me to reach every part of the middle ear without difficulty; and after curetting that thoroughly, using formalin, from one

to ten per cent, I very rarely have occasion to do more than to congratulate myself upon the result. Whenever I have an acute mastoiditis to deal with and periostitis, I never operate until first I have thoroughly exhausted every other method of drainage through the middle ear and applied ice compresses and leaches. I have had very young children to deal with; I have had people eighty years old to deal with. I have seen conditions which would make it almost criminal for a man not to adopt the radical operative measures adopted by our advanced thinkers and operators of to-day, and yet, for one reason or another I have not been permitted to operate upon them and they have gotten well. Just the same question arises, that the surgeon has to deal with in appendicitis. We all know that eighty per cent of the cases of initial appendicitis recover whether operated on or not. And while I am particularly sensitive upon that point, having had an extraordinary experience in my own family, the pendulum will surely swing the other way. There are many reasons why it is not fair to an intelligent and conscientious surgeon, or to a sensitive patient, to produce the conditions which result from the ordinary radical mastoid operative measures. I coincide further with the position that has been taken that if you operate intelligently and persistently by removing all the debris of the middle ear, you rarely have occasion to deal with mastoiditis unless it is a case of extreme neglect, or an acute infection.

DR. MURPHY: In reference to the chisel or gouge of Dr Bryant, we all recognize the importance of avoiding as much concussion as possible in doing the mastoid operation, as we are dealing here with a diseased condition and a diseased brain, and we know that the less concussion there the better. Several years ago I had quite a talk with Prof. McCune whom we all know as a past-master on these operations, and he condemned all chiselling very vigorously. He resorts to a drill entirely in opening the mastoid. I have been looking for something to take the place of the chisel and the mallet, but nothing has been so very satisfactory yet. Randall of Philadelphia got out a set of several gouges which he can operate without the use of the chisel and mallet. I have tried them, but they were not a success in my hands. The most successful instrument in penetrating or opening the antrum I have found, is the Russian perforator. Dr. Ballenger was one of the first men to call my attention to it. That is a very useful instrument in properly selected cases. I shall get one of Dr. Bryant's gouges, and would like

to have him demonstrate in what manner it is best used. In reference to the unpleasant effect of mastoid operations, I think the majority of us have some of these bad results, especially those who are doing hospital work, where the after-treatment often has to be left, more or less, in the hands of the interne. It is an exceedingly difficult matter to instruct an interne in the proper packing of these cases. It matters not how skillfully the operation may have been performed, or how thorough you were; if your packing and after-treatment are not carefully attended you are almost sure to get unfavorable results. We can realize how difficult that must be in the hands of an interne who is not experienced in the operation, when we think how difficult it is to take a case in which another man has operated and that has been turned over to us for treatment. That frequently happens where my predecessor has operated on a number of mastoid cases before going off service, and I have had to follow without any knowledge of what the operation was, or what conditions were present. These cases, unless the greatest care is exercised in the beginning in the toilet and the cleansing of the mastoid, are almost sure to show some unfavorable sequela. I think Dr. Hotz' paper was very opportune, in that it gives us the conservative side of these cases. We should not be too hasty in our operations as we all realize that care and pains, taken in the proper curetting and clearing out of the diseased area, may frequently save the mastoid from an operation.

The suggestions in Dr. Andrews' paper on the subject of transillumination have been very instructive. I have worked that somewhat, but not as thoroughly as I hope to do from now on in view of the very good results the Doctor has given us.

DR. BANE: In the electric lamp Dr. Andrews has shown us, we shall find a very valuable help in cases where we can make use of the electric light.

Dr. Hotz is to be congratulated in doing so much mastoid work and having no deaths. My impression is that the gouge Dr. Bryant has presented here, is a dangerous instrument, one that you can not very well control. It is too long. I believe that in the McKernon instrument you have one that is much safer and one with which you can accomplish quite as much as with the gouge, and be less liable to accident. About three years ago, Dr. Randall called my attention to the McKernon bone spoon, and the gouge that is attached to a similar handle. But as the gentleman from Ohio, who has just spoken, has said, I was not able to remove all of the ebur-



nated bone with either a gouge or a McKernon bone spoon, but had to resort to the chisel and mallet. It is true that in those cases we get a good deal of jar, and the patient suffers with headache for twenty-four hours afterwards on account of the jar. I like the Russian perforator very much for entering the antrum, especially when the bone is eburnated.

DR. FOSTER, Kansas City: I desire to make a few brief remarks upon one subject. I have noticed that in the closing of a wound, some of the general surgeons in Kansas City removing goitres, use subcutaneous sutures, without any scar whatever. I thought it would be a good idea to try this in closing the wounds in mastoid cases. I have only tried it in one case, which was a perfect result. The suture is an interrupted suture. It is buried under the skin entirely, and you bring it together in this position, and when you wish to pull it out it is all at one end; you draw the entire suture out, and there is no scar tissue left whatever. I asked Dr. Ballenger if he had tried it, and he said he had not. I would be glad if some of you gentlemen would try it and let me know the result.

DR. DEVILBISS: I only wish to say one or two words in regard to the technique in the use of the Randall gouge and Dr. Bryant's instrument. The Randall instruments are short like the engraver's tools, and should be handled exactly the same way that the engraver handles his. The finger will always prevent the accident which happened to Dr. Smith if he uses his tools in that way. You will not go too far.

In handling Dr. Bryant's, if you take it in the left hand with the finger just around the curve, and then work it with the right hand, the left-hand finger will always prevent the accident Dr. Smith spoke of with the long handled gouge. That is the rule that should be observed by any one who uses a long handled instrument. You cannot bore a hole through a swing door and not do harm to the opposite side unless there is a complete counter-balance there to the pressure you are applying. It is so with holding the chisel of Dr. Bryant's in the left hand in this manner and working with the right hand.

DR. ANDREWS (closing): I can hardly refrain from making some remarks upon the papers read in connection with my paper, which I suppose I have a right to do, even though I am closing the discussion of my own paper.

With regard to the ossicles and hearing, mentioned in some of the papers, it may be said that if the ossicular chain is broken, and the ossicles are doing no good, the hearing will be better if they are removed. That, I think is true whether they are necrotic or not.

In regard to the use of the front bent gouge, I would say that safety lies not in any instrument. Safety lies in the mind and hand of the operator; and there is no best instrument, in my judgment, for this operation. The instrument is best for each man which he can use best. Dr. Bryant may be able to use this to better advantage than any other instrument. I doubt if I can. I shall try it and see how I succeed.

With regard to the hearing after radical mastoid operations my observations are: 1. When bone conduction is impaired, the hearing will not be likely to be improved by operation. 2. When the hearing is better than the whisper for three feet it will not be improved by operation. If the hearing is less than the whisper for three feet and bone conduction good, we have reason to believe that the hearing will be improved.

In the methods of examination which I have suggested, as in all other means of diagnosis, there is no plan that will work itself. What a man learns from these tests depends upon himself more than upon the methods he uses; depends upon the accuracy of the conclusions which he is able to arrive at from their use. A method of examination should not be condemned because a man has gone wrong in following it. It is not the fault of the method; it is the fault of the application.

DR. STUCKY (closing): I am very grateful for the free reference that has been made to my paper. I believe if I could re-read some parts of it my standpoint would be made clearer than it seems to be to some of the gentlemen here. I suppose there are few of us that have the record that Dr. Hotz has. You can hardly expect that a man in the small town who deals with ninety-nine per cent of his cases which are seen first by the general practitioner in sections remote from his own home, and often in the mountainous counties, will get as brilliant and as rapid results as those of you who live in the large medical centers.

Dr. Stein's reference to the need of education in Kentucky I freely admit, and there needs to be missionary work done along those lines in some other states, too. I want somebody to tell me about my mistakes. I don't need any flowers about my successes. I feel pretty sure on that score.

I agree with Dr. Timberman that, especially in these cases that are septic and broken down and two-thirds dead when they come from an operation, after the operation the hard work begins. Is there any reason, why the average case of a classical mastoid, should re-

quire from three to six weeks, or longer in healing up? And why the average radical mastoid should take from six to twelve weeks in healing up? Now I think I have had pretty good results. I may not have always done a clean operation, but it looks clean and feels clean when I am through with it. But when the leucocytes are away up yonder, from twelve to twenty thousand, and the patient is decidedly septic with not much resistance power left, I congratulate you if there are no unpleasant results following the operation.

DR. BRYANT (closing): I think that we should cordially welcome anything helpful to our diagnosis and any way of demonstrating the need of operation to the general practitioner. Not long ago, in consultation, I saw a case of a suppurative ear. There were no signs of extension, but a very high temperature. The operation disclosed a large necrotic area of the dura and brain tissue. This local condition and the cause of the systemic infection had been overlooked for a long time.

Dr. Hotz recommends that operation be postponed until the indications are imperative. The point of view depends a good deal on what one is looking for, whether for operations or for cure without operations. Most of the cases complicated with caries even can be cured in time if the necrotic area is small. Sometimes it is difficult to decide whether it is best for the patient to have a radical operation performed and be done with it, or to undergo prolonged and expensive treatment. Often it is cheaper to have the operation performed.

Dr. Stucky's remarks apply I think in some degree, to after-treatment. Three-quarters of the mastoid operation depends upon the after-treatment. Even if the operation is a little uncertain, the results are more or less satisfactory, provided the after-treatment is carefully looked after by an experienced surgeon, and not by unskilled assistants.

DR. HOTZ (closing): I am pleased to see that the chief object of my paper was fully appreciated by the audience; that is to say, that if we give our personal attention to our cases we can accomplish better results, than if we let the treatment be carried out in the ordinary way by the patients at home; just as you get better results in the after-treatments of the operations if you attend to the dressings yourself, and do not leave them to the internes.

That necrosis in the tympanic cavity or attic requires more than medical treatment, no one will deny. Nowhere in my paper have

I claimed that I will save a patient from an operation if there is necrosis. But the presence of granulations in the ear, in the attic, or the presence of an inoffensive discharge from the ear, does not indicate necrosis. I make that statement, the statement of one of the gentlemen who discussed the paper to the contrary notwithstanding. And to prove the presence or absence of necrosis, the probe that I showed to you will be an invaluable instrument. You do not have to guess. You can touch it. I simply wanted to show that you do not need to be so rash as to do an extensive operation because there is a chronic condition in the attic which can be cured. The gentleman who opened the discussion said: What means a cure? The ear may be dry for a number of months or a year or two years, he said, and still necrosis exist. I beg to differ with him. A patient often says an ear is dry and the doctor may look in and find it dry. That is just where the importance comes in of investigating the ear a little better than merely by ocular inspection. The ear may be dry because there is not enough secretion to run out or run down into the tympanic cavity. But if you take one of those little applicators of cotton and swab it around in the attic; you will find the cotton moist, or you will bring down some crusts of dried up secretions. Then I do not call a case cured. But if I bring the cotton out after thoroughly wiping in every direction, and it comes down absolutely clean and dry, I am sure I am entitled to think the lining of the attic is in a satisfactory condition. If after two years that patient should come back with a discharge from the attic, or from the middle ear, he simply has contracted another inflammation. But I would not for that reason, consider that an operation in the past had been indicated.

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## THE SUBMUCOUS RESECTION OF THE SEPTUM, ILLUSTRATED.\*

BY WILLIAM LINCOLN BALLENGER, M.D., CHICAGO, ILL.

### THE STEPS OR STAGES OF THE SUBMUCOUS RESECTION OF THE SEPTUM.

1. Apply a 1/2000 solution of adrenalin to the entire surface of both sides of the septum on thin pledgets of cotton. These should be left in position for eight or ten minutes.

2. Local anaesthesia by Freer's method:—A small cotton wound probe, slightly moistened in water, is dipped into pulverized cocaine, and applied about 1/2 minute, by massage, to each side of the septum. An application should be made every seven minutes. From four to eight applications induce complete local anaesthesia. Occasionally a 20% solution of cocaine applied over the septum with thin pledgets of cotton acts better than the above method.

3. Blanching, and local anaesthesia being induced, the *incision of the mucoperichondrium upon one side only* by Hajek's or Killian's method is performed.

4. The mucoperichondrium (and periosteum) is next elevated upon the *side* of the incision.

5. The incision is next carried through the cartilage, but not through the *opposite* mucoperichondrium. To carry the incision through both membranes results in a permanent perforation, unless one side is closed by suture.

6. Elevate the mucoperichondrium on the opposite side, by introducing the elevators through the incision in the cartilage.

7. Remove such portion of the cartilaginous septum as may be necessary, with the "swivel knife."

8. Remove the deflected portion of the perpendicular plate of the ethmoid bone with the submucous saws, or with the Foster-Ballenger biting forceps.

9. Remove the bony ridge near the floor of the nose, by fracture, or with the gouge and mallet.

10. Insert a gauze dressing, or Simpson's sponge tents, into each nostril, to coapt the mucoperichondria. These serve the double purpose of preventing profuse hemorrhage, and the formation of a haematoma between the mucoperichondria.

11. Remove the dressings in twenty-four to forty-eight hours. A second dressing is unnecessary, unless there has been loss of mucous membrane. In this event it may be necessary to introduce dressings daily, until the denuded area is healed by granulation.

#### ACCIDENTS AND SEQUELAE.

1. Laceration of the mucosa in removing the cartilage.
2. Tearing the mucosa in elevation.
3. Tearing the mucosa in removing the perpendicular plate of the ethmoid.
4. Tearing the mucosa in removing the bony ridge.
5. Exciting an acute sinusitis upon a pre-existing chronic sinusitis.
6. Surgical fever.
7. Sepsis from retained secretions.
8. Perforation from opposite incisions or lacerations through the opposing mucoperichondria.
9. Sinking in of the bridge of the nose.

#### THE AUTHOR'S CONTENTION AS TO THE FREQUENT INTRODUCTION OF INSTRUMENTS BETWEEN THE MUCOPERICHONDRIA.

The chief element of danger to the successful performance of the submucous resection of the septum narium is the perforation of the septum. While a perforation is not a serious sequellae, it is, nevertheless, desirable to avoid it if possible. My endeavor has been, therefore, to devise a method at once speedy, and relatively safe. To do this it seemed wise to devise or adapt an armamentarium requiring but few introductions of instruments.

For the removal of the cartilage the author's "swivel knife" was invented in February, 1905. In nearly all cases but one introduction of this instrument is necessary.

For the removal of the perpendicular plate of the ethmoid bone the submucous saws are adapted from Kyle's models. Another, and, the author hopes a still better instrument for this purpose, is the Foster-Ballenger bone-cutting forceps referred to under Figure (30).

For the removal of the deformed vomer, or ridge, the author has introduced a forceps for fracturing it from its attachment to the superior maxillae.

It is thus apparent that his aim is to simplify the three major steps of the operation.

Thus far Hajek's elevators seem to be best suited for the separation of the mucoperichondrium from the cartilage.

Additional reasons for adopting a simple armamentarium, requiring few introductions for instruments, are the lessened shock, and the shorter time required for the performance of the operation. These are all-important matters from the patient's point of view. The patient has a right to expect the best results, with the least shock, in the least period of time, and with the greatest safety to his septum. The author hopes the method illustrated in this paper possesses these qualities.

Figure 1.—Showing a high, wide deviation, located in the cartilage and perpendicular plate of the ethmoid bone. Figure 2, shows the anterior view of the same. It is obvious that the "swivel knife" will not embrace so wide a deviation. It is better, therefore, to remove the deflected cartilage in two pieces. That is, elevate the mucoperichondrium above the crest of the deviation, and over the whole area on the concave side, then introduce the swivel knife through the upper limit of the Hajek or Killian incision, pushing it along the ridge of the nose, thence downward and backward, to the crest of the deviation, thence forward along the crest, until it emerges from the anterior incision. This portion of cartilage is then removed with forceps. Having removed the upper portion of the deflected cartilage, it is obvious that the lower portion can be readily bent towards the median line (Fig. 3). This allows of the elevation of the mucoperichondrium on the under side of the crest. To have attempted the elevation in this position, before the removal of the upper portion of the cartilage, would have almost certainly

resulted in laceration of the mucoperichondrium. With the upper edge (crest line) of the cartilage liberated, the elevator readily

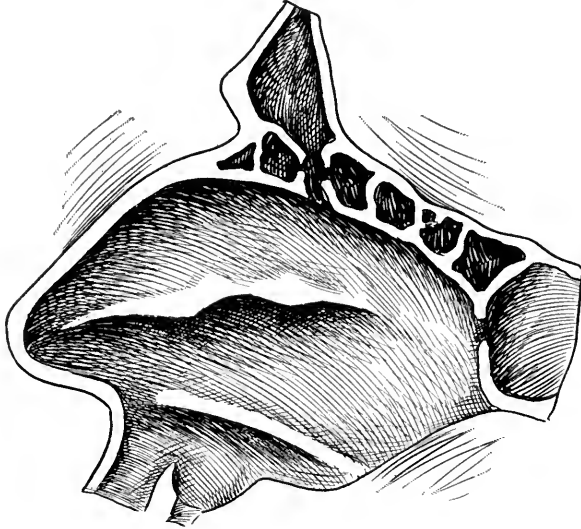


Fig. 1.

crowds the lower portion of the cartilage towards the median line, thus relieving the tension from the mucoperichondrium. After

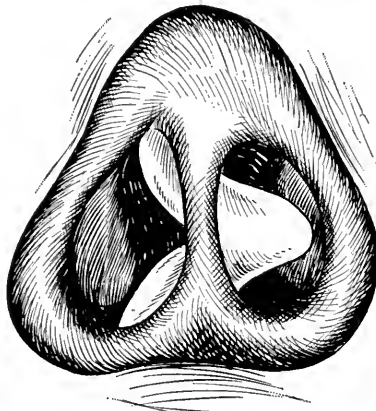


Fig. 2.

elevating the mucoperichondrium on the under surface of the deviated cartilage, the swivel knife is used to remove it.

Figure 2.—Shows the anterior view of Figure 1.



Figure 3.—These diagrams illustrate the principles involved in elevating the mucoperichondrium on the under surface of a cartilaginous crest. (a) Shows the extent of the primary elevation, the narrow lines being the mucoperichondria, the heavy line the deflected

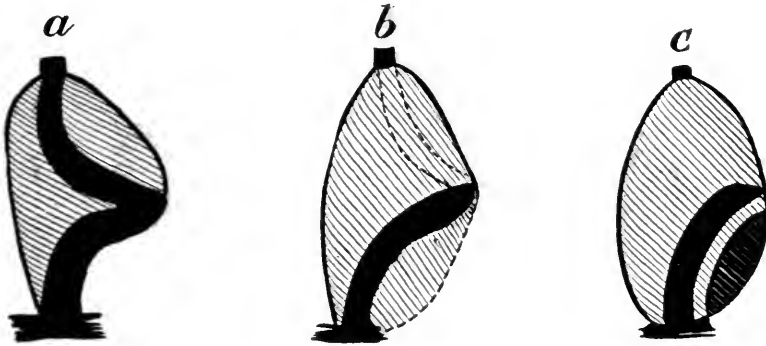


Fig. 3.

cartilage. (b) Shows the upper portion of the cartilage removed. (c) Shows the Hajek elevator crowding the lower portion of the cartilage towards the median line, thus relieving the tension that would otherwise be exerted upon the mucoperichondrium. The



Fig. 4.

removal of the upper half allows the lower half to be separated from the mucoperichondrium without tearing it.

Figure 4.—This diagrammatic section shows a compound deviation of the septum; a low ridge with a sharp crest, and an upper curved deflection towards the opposite side. This is a very common

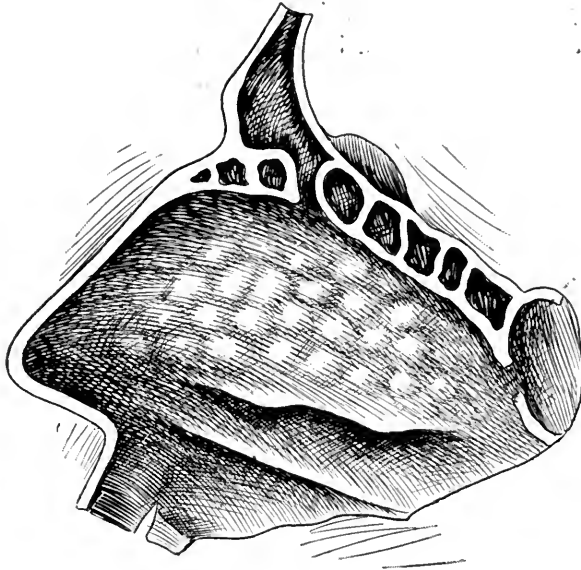


Fig. 5.

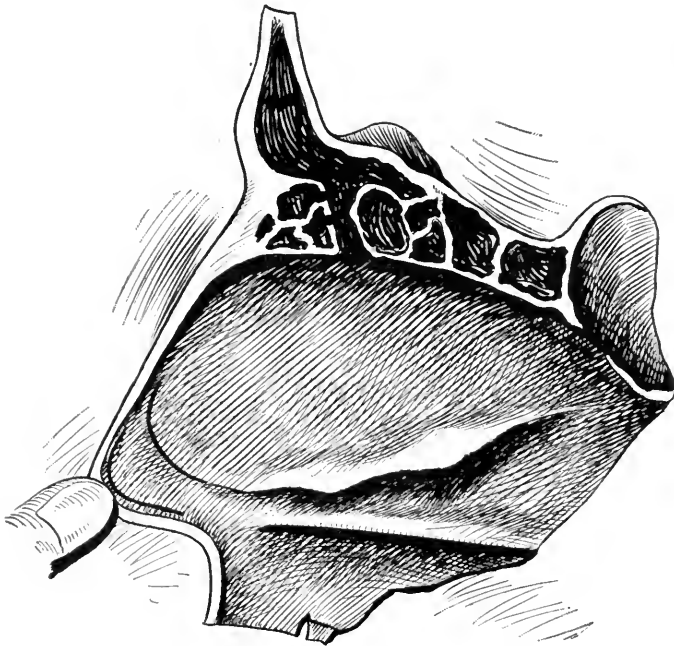


Fig 6.

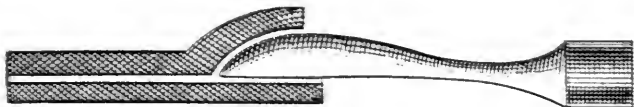
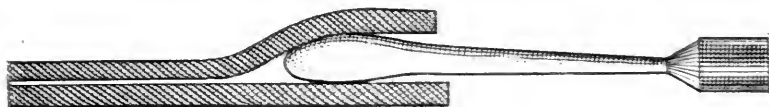
*a**b*

Fig. 7.

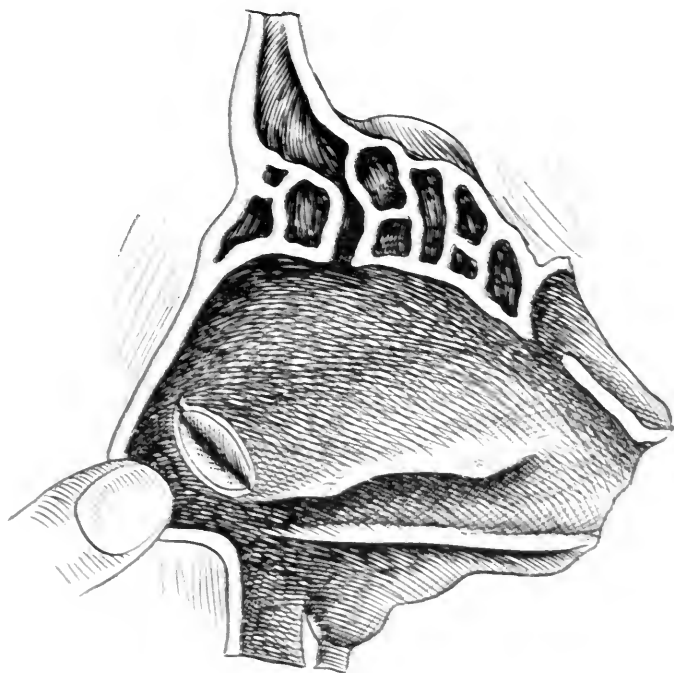


Fig. 5.

type of deviation. The lower ridge obstructs the inferior and middle meatus, while the upper bend obstructs the aeration and drainage of the superior meatus, and the accessory sinuses upon that side of the head. The lower deformity presses against the inferior turbinal, while the upper presses against the middle turbinal. It is just as necessary to correct one deviation as the other. This may be done by the sub-mucous resection of the septum. The lower ridge is composed largely of bony tissue, while the upper curved portion is composed in its anterior portion of cartilage, and its posterior portion, of the perpendicular plate of the ethmoid bone. Heretofore, we have been satisfied to remove the lower ridge with a saw, the upper deviation being allowed to remain. Or perhaps the anterior end of the middle turbinal was removed. The submucous resection is peculiarly adapted to this very common type of deviated septa.

Figure 5.—This illustrates a septum with numerous nodular elevations, and a small ridge. The surface of the septum is not smooth, but on the contrary is quite uneven, though in no place is there a marked deviation, except, indeed, the lower ridge. A septum of this type presents a mucoperichondrium very difficult to elevate. It is often quite closely adherent, and the irregular surface renders the elevation still more difficult. In addition, the membrane is often quite thin and friable. It is, in all probability, the seat of an old perichonritis.

Figure 6.—This figure shows the approximate location and extent of the incisions through which the submucous resection of the septum is performed. The one at the extreme tip of the nose is the Hajek, while the one located more posteriorly, at the junction of the vestibular skin and mucous membrane, is the Killian incision. Personally the author usually elects the Killian incision, as the elevation is easier from this point. The cutaneous membrane, more anteriorly, is quite adherent. The author prefers the Hajek incision when the deflection is well forward, as to extend the incision to the anterior end of the ridge, courts laceration of the mucous membrane during the elevation. My rule is therefore, (a) to make the Hajek incision when the ridge extends well forward, and when the septal cartilage at its tip is deflected so as to require removal; (b) to make the Killian incision when the ridge does not extend well forward, and the septal cartilage at its tip is not deflected.

The author nearly always makes the incision upon the patient's left side, as it is easier to do so with his right hand. All other

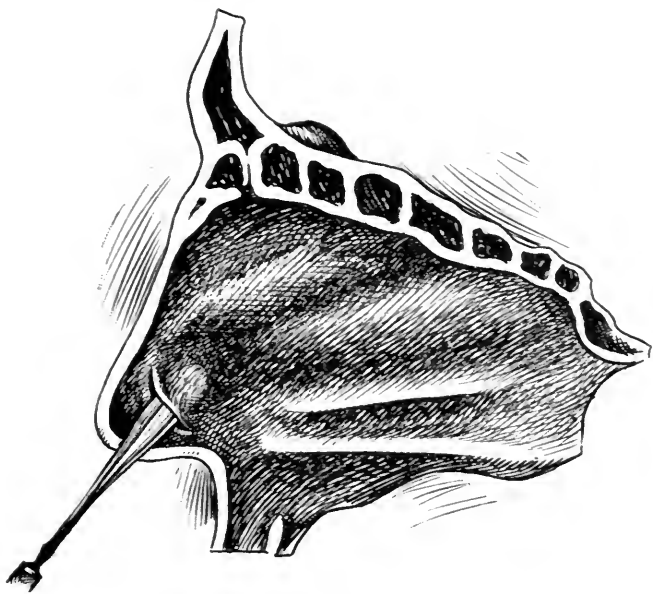


Fig. 9.

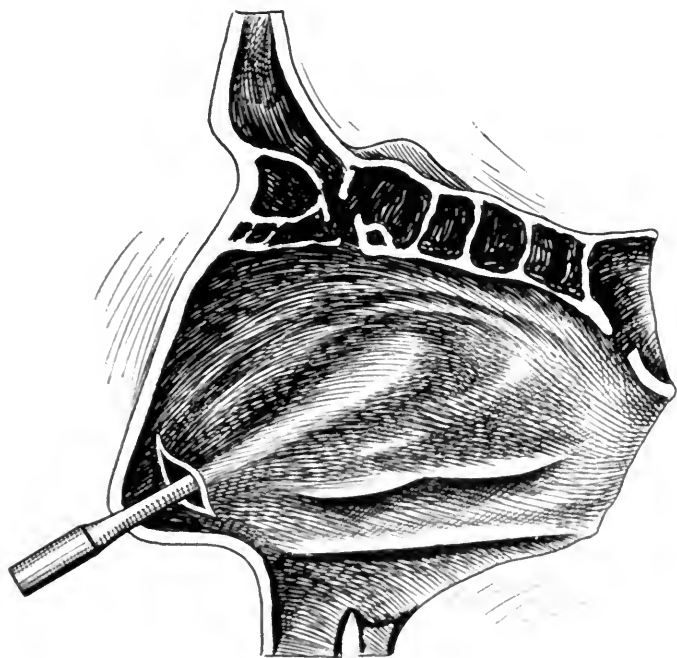


Fig. 10.

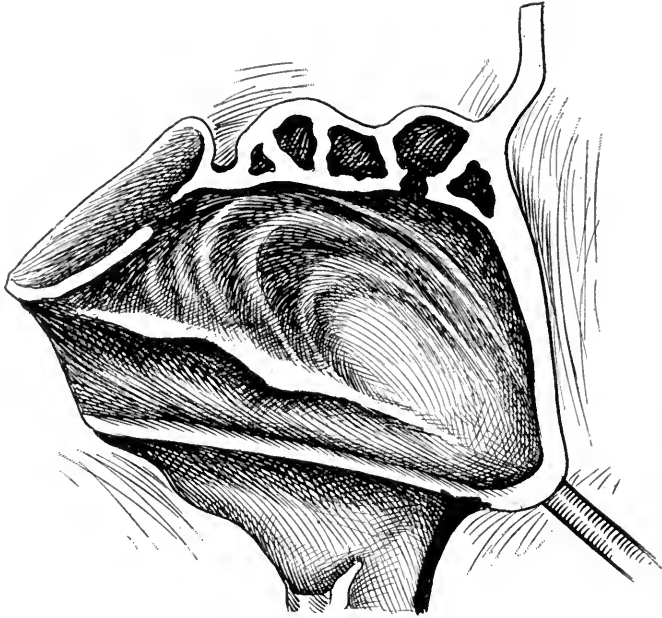


Fig. 11.

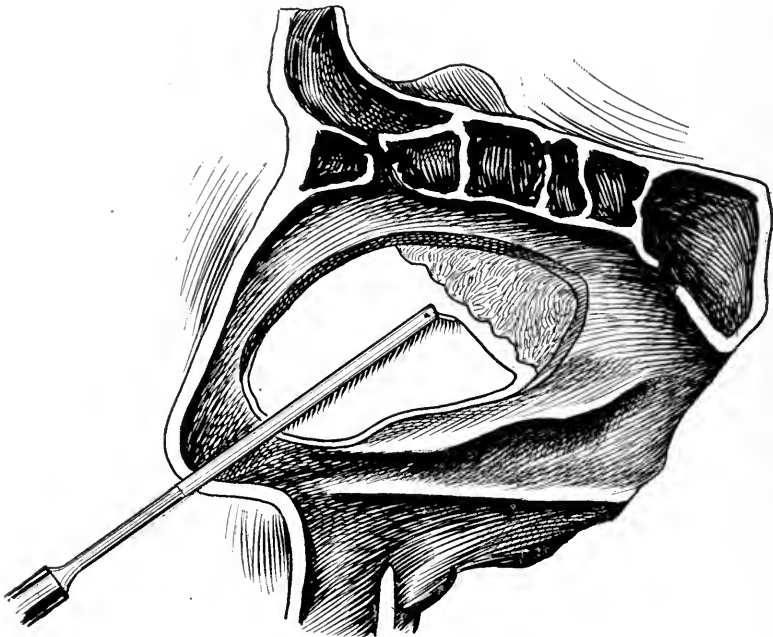


Fig. 12.

writers recommend making it upon the side of greatest convexity, or on the side of the ridge. The author does not find any advantage in this, and in 100 cases has adhered to the above rule, with but two exceptions.

Figure 7.—For the elevation of the mucoperichondrium the author **has depended upon the Hajek elevators** shown in Figs. 7 and 27. One is flat upon one surface and convex upon the other. The other is convex upon both surfaces. The plano-convex elevator is used to start the elevation of the mucoperichondria, while the biconvex is used to complete it. The principle involved in the elevation is shown in Figure 7: (a) shows the plano-convex elevator starting the elevation, its flat surface being applied to the cartilage; (b) shows the biconvex elevator lifting the membrane ahead of its tip or edge. This constitutes the safety of the instrument. The elevation may be rapidly done with this elevator with little danger of tearing, whereas, if a flat, sharp elevator is used, it is necessary to proceed with great caution so as to avoid injury to the mucosa.

After starting the elevation with the sharp elevator (plano-convex), it usually requires less than one minute to complete it with the dull or biconvex elevator.

Figure 8.—Shows the Killian incision on the left side of the septum. The small flap made by the curved incision is elevated and turned back, exposing the cartilage to view. The incision has also been extended into the cartilage, as shown by the dark line. The elevation may be carried still further with the plano-convex elevator, though the bi-convex one should be used from this stage on.

Figure 9.—This shows the sharp or plano-convex elevator at work. It should not be used beyond the depth shown in the illustration, as to do so invites laceration of the mucous membrane.

Figure 10.—Shows the dull or bi-convex elevator rapidly separating the mucoperichondrium from the left side of the septum. The separation is only carried down to the crests of the two elongated spurs. To attempt to elevate below the crest would result in laceration of the mucous membrane in this region. When we come to deal with the removal of the ridge, it will be explained why it is unnecessary to elevate the mucoperichondrium below the crest.

Figure 11.—In this illustration the dull elevator is shown doing its work through an incision in the cartilage on the opposite side from the Killian incision. The wave-like lines indicate the area of elevation. It will be noticed that they stop at the crest of the ridge.

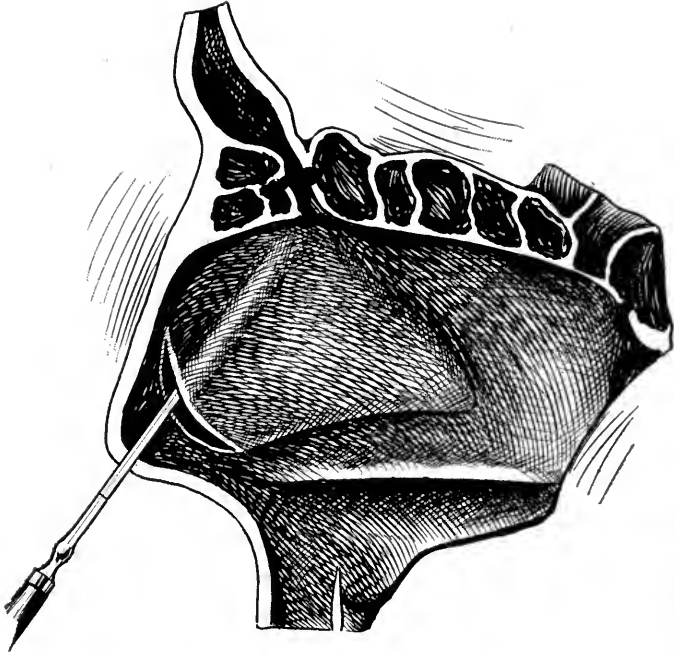


Fig. 13.

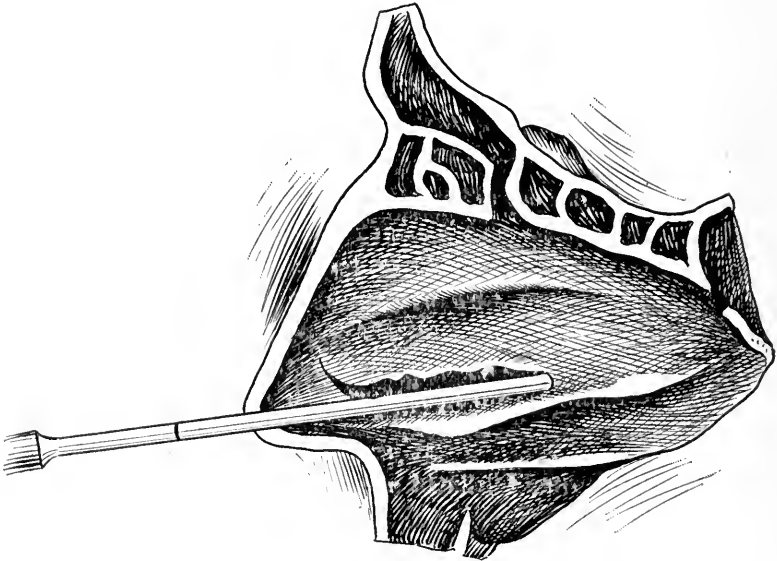


Fig. 14.



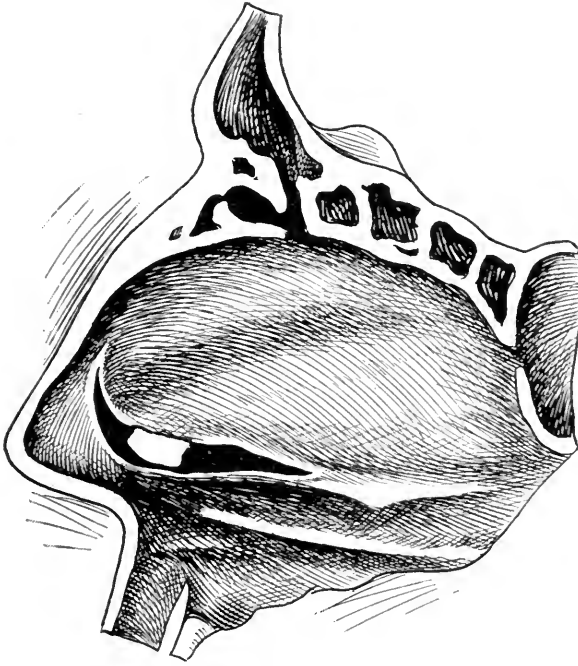


Fig. 13.

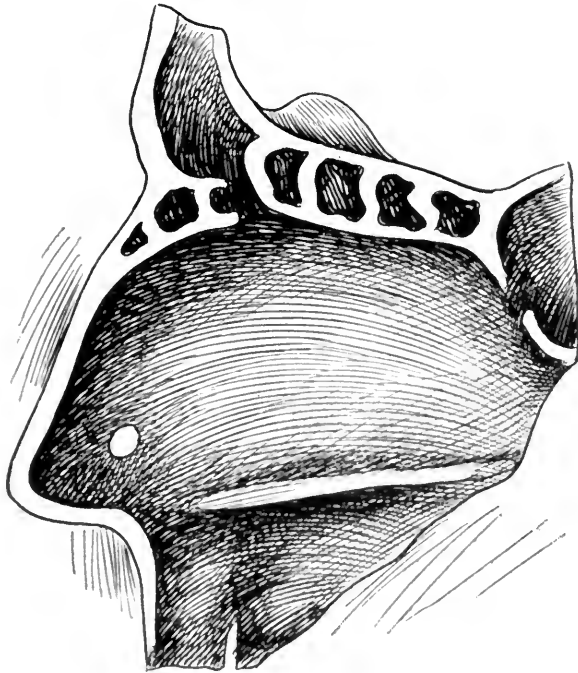


Fig. 14.

Under no circumstance should the operator attempt to elevate the membrane below the crest. It is absolutely unnecessary, and if attempted will tear the mucosa.

Figure 12.—Showing the author's "swivel septum knife" in the act of removing a portion of the septal cartilage. The mucosa is removed to show the swivel knife and its line of incision. The stirrup, or swivel blade, swings between the prong-tips of the handle, and the direction of its cutting edge is controlled by the resistance of the cartilaginous tissue through which it is passing. That is, it follows the prong-tips, no matter in what direction they may be directed. Under no circumstance should the incision of the cartilage be carried farther anteriorly than is shown by the anterior heavy shaded line. Enough cartilage should be left to support the bridge of the nose. The author has one case, in which too much cartilage was removed, and there is moderate sinking in of the bridge of the nose in consequence. This will be corrected by paraffin injections when contraction is complete.

Figure 13.—Showing the same as Figure 12, except the mucous membrane is intact, as it is in the actual operation. The "swivel knife" is introduced between the mucoperichondria with its prongs astride the cartilage. It has cut, thus far, along the upper margin of the vomer, and along the antero-inferior border of the perpendicular plate of the ethmoid. It only remains to pull the swivel knife downward and forward, parallel with the present position of the instrument to complete the excision of the cartilage. Having done this, the cartilage is removed with forceps through the incision, as shown in Figure 17.

Figure 14.—Showing one of the accidents, that is a laceration of the mucoperichondrium with the swivel knife. The exposed prong was not placed beneath the mucoperichondrium, but was astride both the cartilage and the membrane. This accident need not occur if the septum speculum shown in Figure 34 is used. Indeed, it need not occur if ordinary care is exercised in introducing the swivel knife. Such a laceration is not necessarily inimical to the final success of the operation, unless the mucosa on the opposite side is also perforated. If both membranes are perforated, at points exactly opposite, a permanent perforation will persist unless one side is closed by suture. The chief objection to the above, is in the fact that the healing process is prolonged several days. Healing takes place by granulation, instead of by first intention. The author once

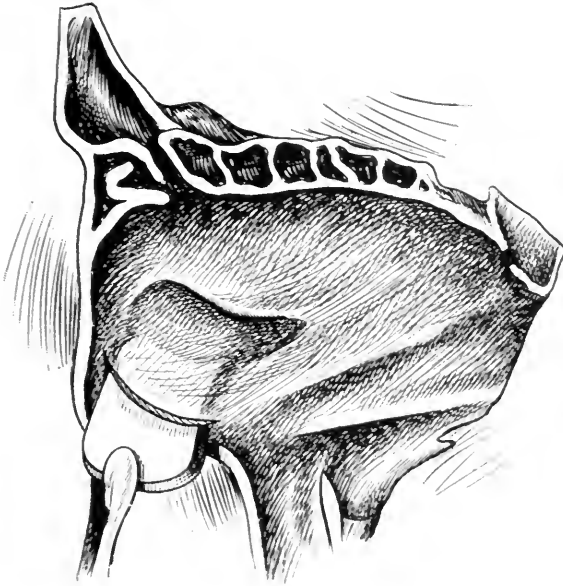


Fig. 17.

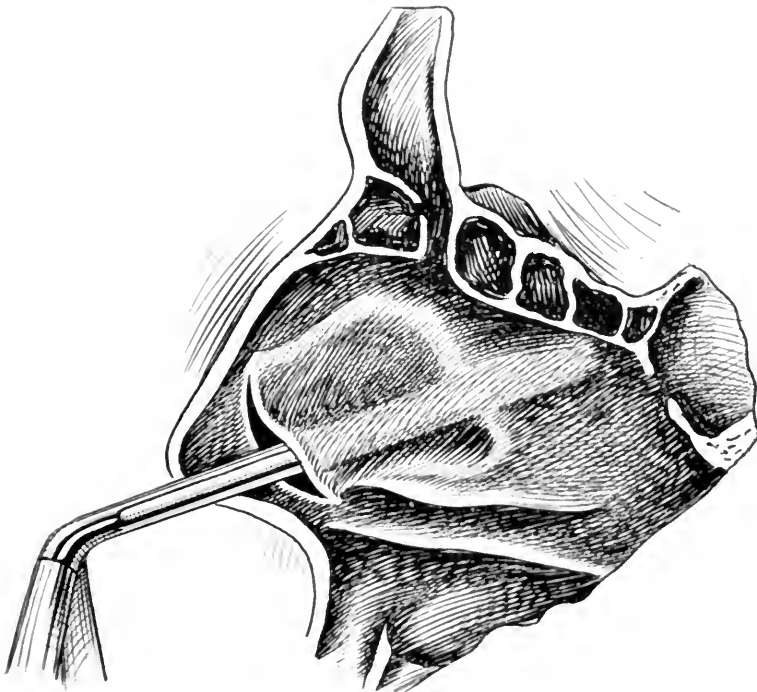


Fig. 18.

removed an area of mucosa corresponding with the area of cartilage removed, with no untoward result other than the delayed healing.

Figure 15.—Showing a laceration of the mucosa on the left side of the septum, and a smaller one on the right (the white area). In this case a permanent perforation the size of the smaller laceration will follow, unless one of the rents is closed by suture.

Figure 16.—Showing a permanent perforation, from the laceration of both perichondria, at points exactly opposite. If one membrane is perforated anteriorly and the other more posteriorly a perforation will not follow.

Figure 17.—Showing the cartilage in the process of removal with forceps through Killian's incision. The time required for the removal of the cartilage, including the excision with the swivel knife, need occupy no more time than one minute. The mucoperichondria are, of course, elevated prior to the excision and removal of the cartilage.

Is it necessary to remove the cartilage when it is not deviated so as to obstruct the nose?

Yes; it should be removed so as to expose the deviated perpendicular plate, and the deformed upper margin of the vomer (ridge).

Figure 18.—Showing the cartilage removed, and the deviated portion of the perpendicular plate of the ethmoid being removed submucously with the Foster-Ballenger forceps (Figure 30). The bony plate is being bitten away piece by piece until the upper bend, shown in Figure 4, is removed.

Figure 19.—Showing the author's method of removing the perpendicular plate of the ethmoid. Kyle's saws have been modified by the author so as to adapt them to submucous work. The plate is sawn through with the straight saw, in two lines parallel to each other, and then they are connected at their posterior extremities, by a cross line with the right-angle saw. The rectangular piece of bone is then removed *en masse* with dressing forceps. This method preserves the specimen for inspection. The author has used this method in a few cases with great satisfaction. In this illustration the mucoperichondrium is removed to show the method of using the saws. In the actual operation the saws are introduced between the mucoperichondria.

Figure 20.—Showing the V-shaped gouge in position. The final step in the operation consists in the removal of the lower bony ridge. This is usually done with a gouge and mallet. The gouge is

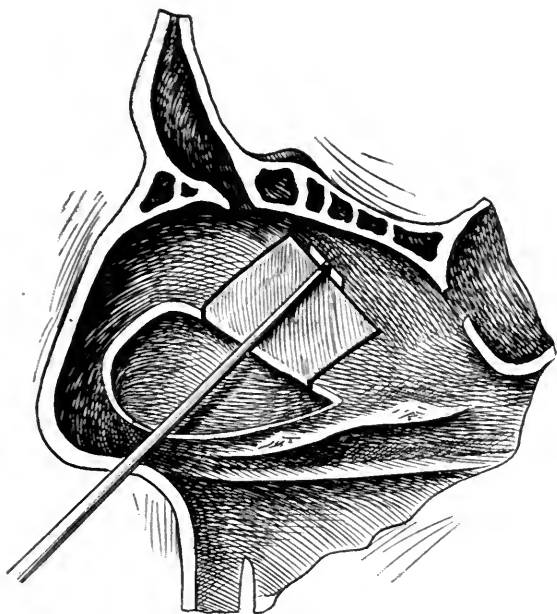


Fig. 19.

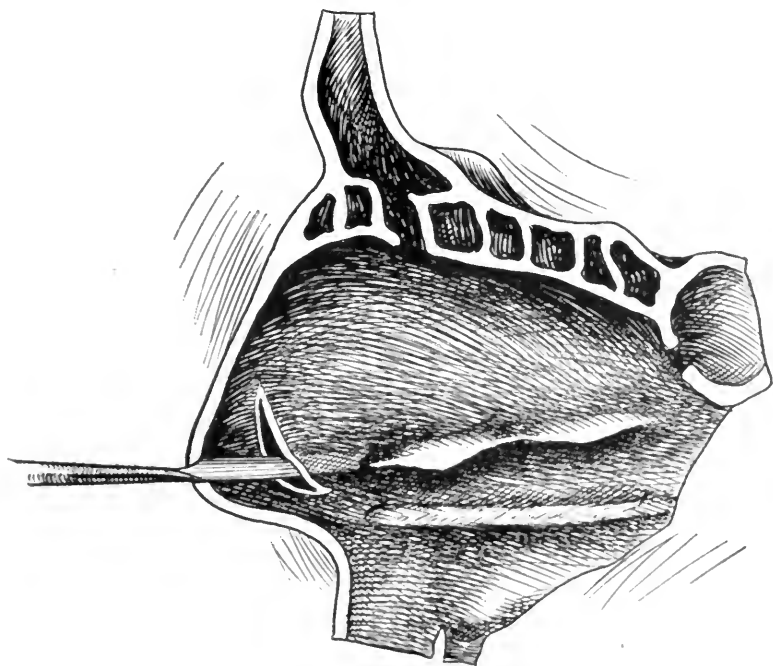


Fig. 20.

driven into the ridge, until it splinters from its attachment to the superior maxillae. The mucoperiosteum, below the crest of the ridge, becomes separated in the process of splintering, hence the wisdom of discontinuing the elevation of the membrane at the crest. This step of the operation is not always easily accomplished without perforating the mucous membrane. Care and patience are essential requisites. Having splintered the ridge from its attachment it may be removed through the Killian incision with forceps.

Figure 21.—Showing the author's method of removing the bony ridge. Forceps similar to the Adams or Asch (Figure 40) is used to fracture the ridge (Vomer) from its attachment to the superior maxillae. A blade is introduced into either nostril *outside of the mucous membrane*, the ridge seized, and with a twisting motion, it is fractured from its attachment to the superior maxillae. In fracturing, the mucoperiosteum below the crest of the ridge becomes separated. Dressing forceps are now introduced through Killian's incision, and the fragments of the ridge removed. The time required is shorter than with the gouge and mallet, and it is much easier done. The procedure is painless, and is attended by little or no shock. It should be remarked that the cartilage, and a portion of the perpendicular plate of the ethmoid have already been removed, hence the force of the fracture is not transmitted to the cribiform-plate and the brain. The author is having forceps made with the edges of the blades beveled, so as to avoid the possibility of their cutting the mucosa as they are twisted from side to side. The blade of the forceps should not be placed upon the floor of the nose, but about  $\frac{3}{16}$  of an inch above it, so that in rolling them from side to side, in the fracturing process, they will not strike the floor, and with this fulcrumage tear the mucosa. The author has used this method seven times, with good and speedy success in five of the cases. In one, the mucosa was torn near the floor, on account of placing the forceps blades too near the floor. In the other, the vomer was not ossified on account of the youth of the patient.

Place the blades of the forceps high enough to permit them to roll from side to side without striking the floor of the nose. With the edges of the blades rounded, and the proper placement of the forceps, the vomer (ridge) may be fractured from its maxillary attachment without endangering the continuity of the mucosa.

The dark oval line indicates the area of tissue removed above the crest, before its fracture is attempted.

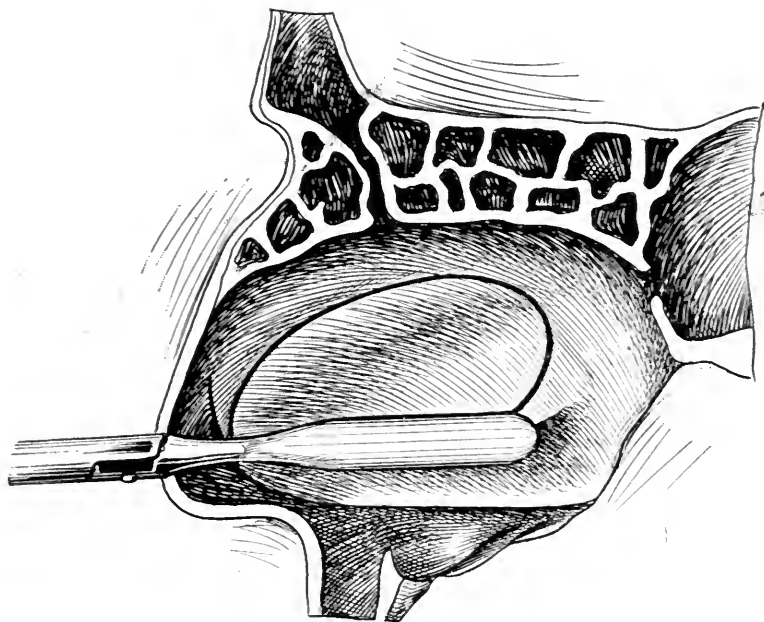


Fig. 21.

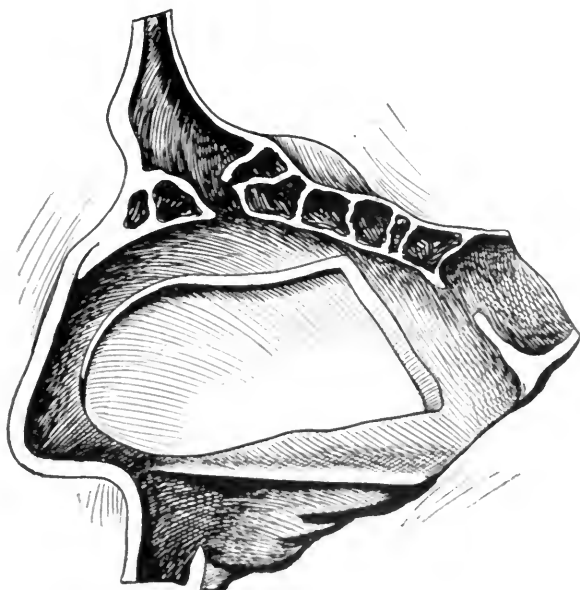


Fig. 22.

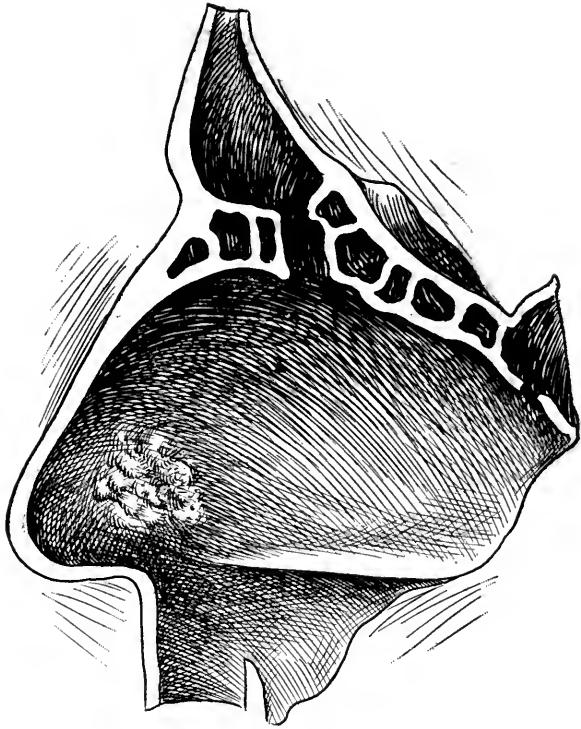


Fig. 23.

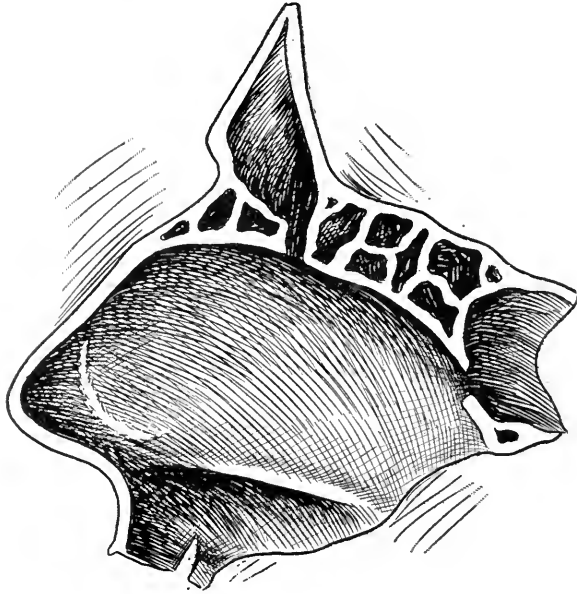


Fig. 24.



Figure 22.—Showing the amount of tissue removed when the cartilage, a portion of the perpendicular plate of the ethmoid, and the ridge are removed. It is not necessary, in all cases, to remove this much of the framework of the septum. In one case, however, the author removed the entire framework except the cartilage supporting the bridge and tip of the nose.

Figure 23.—Showing the postoperative encrustation at the site of the Killian incision. They are usually easily removed, though in two of the author's cases, they were of glue-like consistency, and adhered accordingly. The patient should be instructed to introduce vaseline into the vestibule of the nose twice daily, to prevent encrustation. The crusts persist for from one week to four weeks.

Figure 24.—Showing a septum corrected by the submucous resection of the deviated portion of its framework. The white line anteriorly is the location of the scar of the Killian incision.

The septum may be made absolutely plane and perpendicular by this method of operating, hence the superiority of the submucous operation over other methods. It is not claimed by the author that other methods of operating should not be done. On the contrary there are cases in which they should be done.

#### AXIOMS.

1. Never do a long operation, when a short one will do as well.
2. *Make haste slowly* in starting the elevation of the mucoperichondrium. Any other manner of haste is liable to result in a permanent perforation.
3. Do not extend the Killian incision through both mucous membranes, as to do so, is tempting providence in the form of a perforation.
4. A few instruments infrequently introduced, between the membranes should be the aim.
5. Don't "fish" between the perichondria for what you want, but look, see, feel, then remove what you want. "Fishing" in the cavity is liable to tear the mucosa.
6. A sharp-pointed instrument in a cavity is a dangerous thing. A dull one is safer.
7. The mucoperichondrium is easily and quickly lifted with a blunt elevator in 95 per cent of all cases.

8. A sharp elevator is a dangerous instrument, except in the hands of an experienced and careful operator. It is an instrument for emergencies, and not for general use, at least in the hands of the average operator.

9. The external ridge of the nose needs support, hence leave plenty of cartilage in this region for this purpose.

10. Never make a move until you know what you are doing. Then do it.

11. Do not operate to straighten the septum, rather to remove obstructive lesions.

12. Operate with a view to the patient's comfort and permanent relief. This is what he employs you for.

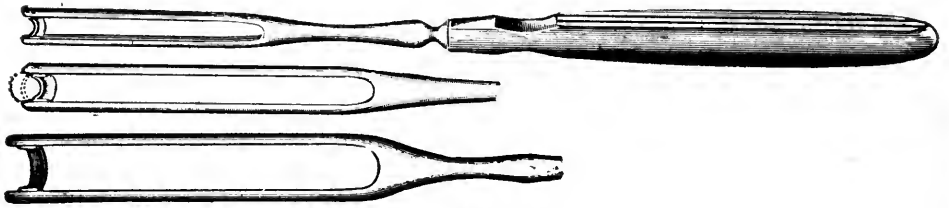


Fig. 25.

Figure 25.—The author's "swivel knife" is made in two parts; the handle and the prongs, and the swivel knife. It is only used to remove the cartilaginous portion of the septum, which it does in one piece in a few seconds. The above illustrations show the two widths of the swivel knife. The wider one is for extreme deviations of the septal cartilage, and for the removal of part, or all of the middle and inferior turbinated bodies, though others may be used.

The swivel blade is swung on pivots between the prong tips, between which it freely swings in a complete circle. The direction of the cutting edge (concave edge) is controlled by the resistance of the cartilage, or other tissue through which it is passing. In the submucous operation the cartilage is removed *en masse* within a few seconds of time, one minute rarely being required for this purpose. The operation is thus shortened, the number of instrumentations considerably diminished, and the specimen is preserved for inspection. The "swivel knife" renders the submucous resection of the nasal septum, especially the cartilaginous portion, simple and at-

tractive. The use of the instrument is so easily mastered that a novice should feel at home with it after the first trial.

Figure 26.—The author's mucosa knife with which the preliminary incision through the mucoperichondrium and cartilage is made.

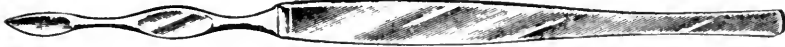


Fig. 26.

The blade is short to obviate the liability of cutting the alae of the nose.

Figure 27.—The author's modification of Hajek's mucoperichondrial elevators, on one handle, one tip on either end. One is semi-sharp, the other blunt. The sharp tip is used to start the elevation, the blunt one to complete it. In nearly every case more time is consumed in starting the elevation, than in completing it

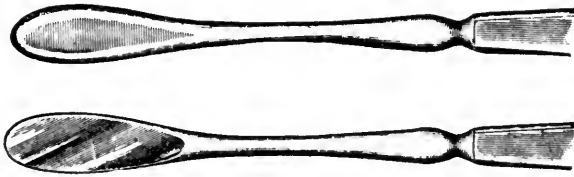


Fig. 27.

with the blunt instrument. Ordinarily the separation can be completed with the blunt instrument in less than one minute, whereas, to start it with the sharp elevator may require five or more minutes. In very exceptional cases a sharp elevator may be required to complete the elevation.



Fig. 28.

Figure 28.—The author's gouge for the submucous removal of septal ridges. The gouge is an arc of a circle and the cutting-edge is V-shaped, thus enabling it to engage readily in the septal ridge.

Figure 29.—Kyle's septum saws. The author has modified them so as to adapt them to the submucous resection of the perpendicular plate of the ethmoid, as shown in Figure 19.

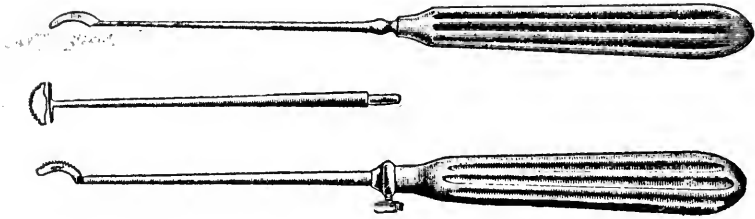


Fig. 29.

Figure 30.—The Foster-Ballenger septum bone forceps, for the removal of the perpendicular plate of the ethmoid. Two bites with one introduction of the instrument removes all that is necessary in the average case. This instrument is designed for the purpose of

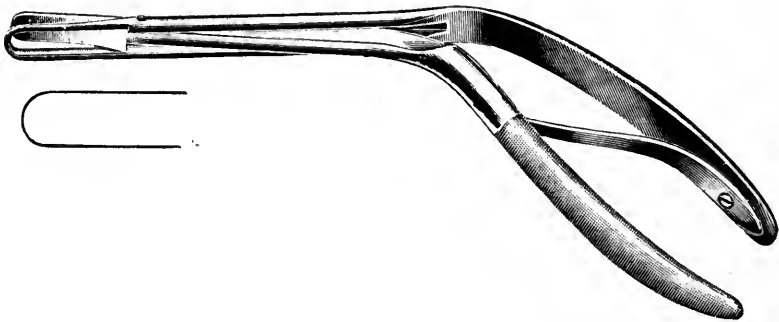


Fig. 30.

diminishing the number of times the instrument need be introduced between the mucoperichondria. With each additional introduction of an instrument there is added liability to lacerate the membrane. Endeavor, therefore, to remove as much tissue as possible with each instrumentation.

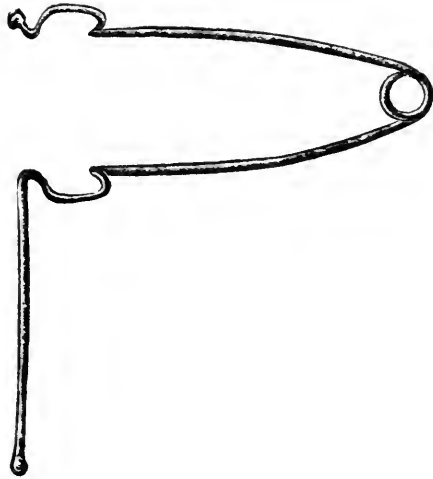


Fig. 31.

Figure 31.—Heffernan's nasal sepculum, the best the author has used for intra-nasal operations. They come in pairs.

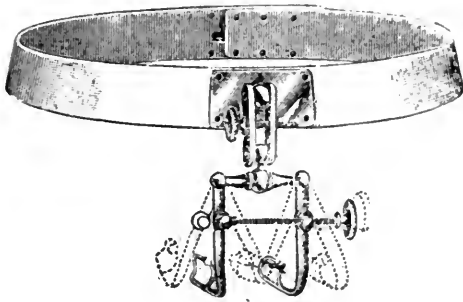


Fig. 32.



Fig. 33.

Figure 32.—Beck's nasal speculum, with a head-band attachment.

Figure 33.—Beck's septum speculum. Also used to clamp the mucoperichondria while packing the nasal chambers.

Figure 34.—Foster's septum speculum. This is a useful instrument in introducing the narrow swivel knife between the mucoperichondria and astride the cartilage. The blades of the speculum are introduced submucously through the Killian or Hajek incision, one on either side of the septal cartilage. The swivel knife is introduced between the septal blades, and astride the cartilage. When



Fig. 34.

it has penetrated the cartilage along the floor of the nose sufficiently to be well within the membranous pouch, the speculum should be removed, and the cartilaginous septum encircled with the swivel blade, thus completely severing the desired portion of the cartilage from its attachments. It is then removed through the anterior incision with dressing forceps as shown in Figure 17.



Fig. 35.

Figure 35.—Simpson's sponge tents used by the author to pack the nose after the submucous resection of the septum.

Figures 36, 38 and 39 show other models of the author's swivel knife. Figure 36 was the first model invented by the author. It has a single prong. Figure 37 shows a universal cutting-knife, a steel wire stretched between the prongs forming the blade. It cuts with considerable resistance, and is not recommended. The author has also designed a cautery knife similar in appearance to Figure 37,

but the swivel knife is so much simpler and more satisfactory, that it is recommended to the exclusion of all other models of universal cutting septum knives.

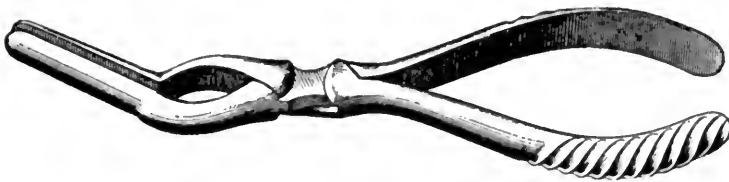
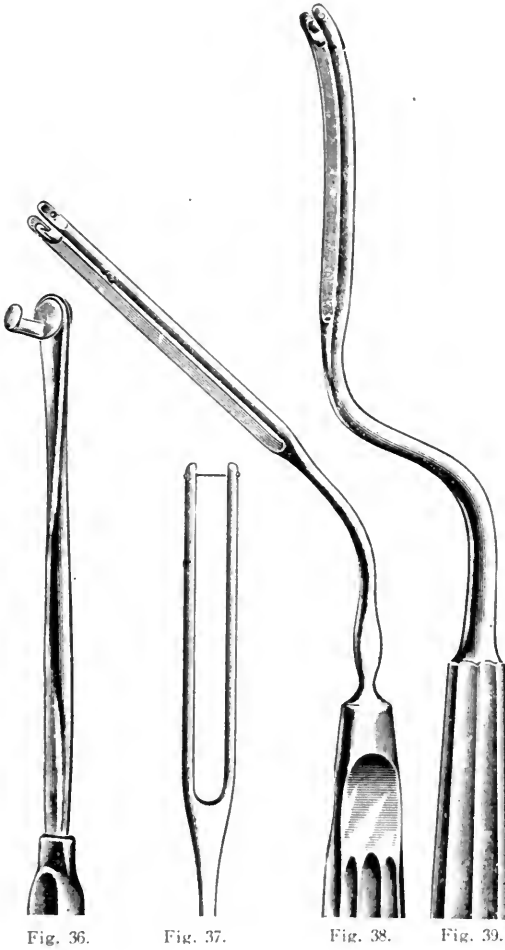


Figure 40.—Septum forceps used to fracture the bony ridge (vomer) from its attachment to the superior maxillae in the submucous operation. The inner edges of the blades should be beveled (see Figure 21).

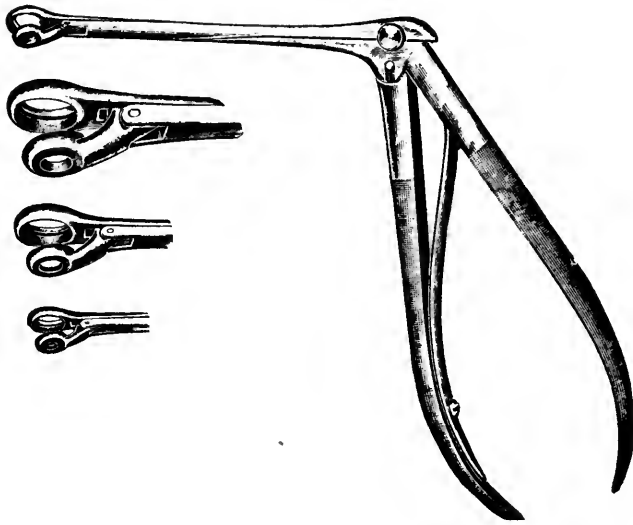


Fig. 41.

Figure 41.—The Grunwald-Freer bone forceps.

INSTRUMENTS USED IN THE SUBMUCOUS RESECTION.

The following instruments may be used in the submucous resection of the septum, though but few of them are necessary. The ones used by the author are shown in Figures 25, 26, 27, 29, 30, 31 and 34. Some of these may be dispensed with, namely 26, 28, 31 and 34, as every rhinologist has similar instruments in his outfit which can be utilized in their stead. This leaves a net outfit of instruments which are essential in the performance of the operation:

- (1) 1 Swivel knife, Figure 25.
- (2) Double Elevator, one handle, Figure 27.
- (3) 1 Gouge, Figure 28.
- (4) 1 Bone forceps, Figure 30.
- (5) 1 Septum speculum, Figure 32.



While the Heffernan wire nasal speculum is the best operative speculum the author has used, almost any light nasal speculum can be used with satisfaction. The author's mucosa knife is a convenient addition to the outfit, but is not indispensable, as any narrow bladed scalpel will answer the purpose. Every office is probably supplied with a forceps similar to the Adams or the Asch, hence it is not necessary to include this instrument in the outfit. The author has simply had the edges of the Asch septum forceps beveled to adapt it to the submucous operation.

These remarks are made to show the limited number of special instruments (five in all) actually required for the successful performance of this operation.

As to the Simpson splints, the author finds them admirable for the purpose, easily and quickly introduced and removed with slight danger to the operative field. They may be removed layer by layer, until only one thin plica remains as a film over the septal mucous membrane. If necessary this may be left in position for another day to protect the operative field.

#### CONCLUSION.

The author offers the foregoing pictorial presentation of the submucous resection of the nasal septum as a speedy, safe, simple and successful method of performing the operation.

He has used it in more than one hundred cases with good satisfaction to himself and patients. It is not claimed that all cases are successfully operated by this method. Some are more successfully operated by other methods, or by other operations. The limited experience of the author does not warrant him in forecasting the field in which this method is applicable. It appears, however, to be well adapted to fully 90 per cent of all septal deformities requiring surgical correction.

This paper will not enter into a discussion of the difficulties to be encountered, and the complications and sequellae which occasionally arise. These matters will be reserved for a future communication.

103 State St.

## HEMORRHAGE IN NOSE AND THROAT OPERATIONS.

BY EMIL MAYER, M.D., NEW YORK.

To those of us who are called upon to operate in the various affections of the nose and throat, the question of hemorrhage is by no means the least important one. Obscuring as it does the field of operation, rendering subsequent procedures much more difficult, often placing the patient in a position of extreme danger as to life, and thus making recovery tedious, we surely may well take the time from some of the more abstruse questions that constantly confront us, and give our attention to the question of hemorrhage and its avoidance.

Since the days of our knowledge of the efficiency of the Suprarenal extract and its infinitely superior successor, Adrenalin, for which we have to thank the ingenious chemist, Dr. Jokichi Takamine, much of our work, especially in nose operations, has become much easier of accomplishment. The loss of blood, which formerly amounted to ounces, is brought down to such a minimum that there is practically none at all.

The great advantage in being able to complete the operation at one sitting is by no means a slight one, and in this connection it is but fair to state that the preparation known as Adrenalin has never failed me in producing the effect desired. In one instance, there was a most copious hemorrhage during operation and upon subsequent investigation, it was ascertained that the preparation given me was one of the preparations of the suprarenal extracts, which is on the market under some other name.

In operations in the pharynx and naso-pharynx, the use of the Suprarenal extract is inadvisable, for the reason that we may readily fear a secondary hemorrhage when there is no loss of blood at the time of operating. The action of these remedies being to contract the blood-vessels, for the time being, to render the parts ischemic, it is perfectly natural that there must be a period of dilatation before the final contraction that forms the clot. This period of open blood-vessels, before subsequent contraction, may well be guarded against in the nose, not so however in the pharynx and naso-pharynx. In the latter preventive measures as regards hemorrhage are few.

Fortunately the lymphoid tissue in the naso-pharynx and pharynx is not traversed by large vessels and the tissue itself is soft, and easily removed. It is not customary therefore to take any special measures toward the prevention of the loss of blood at the time of operation for this condition in young children; and perhaps the only precautionary measure and one too often overlooked, is the inquiry into the question of the family history, as regards those known as hemophilics.

An interesting case, well illustrating this phase of the subject occurred in my own practice. A boy aged 12 was brought to me by his mother, on the advice of the family physician, to have his tonsils removed. The tonsils were very large, and the boy had all the symptoms associated with that condition, including recurrent attacks of Follicular Tonsillitis. The mother asked me if there was no other way to treat her son except by the knife, and stated that she was very much afraid of any cutting operation, because she had a brother who had bled for days and days upon the extraction of a tooth, and that her own mother bled for a long time upon the infliction of the slightest kind of a wound. I promptly informed her that I would not attempt any operation on the tonsils of her son with such a family history, but would insist on other methods. By many applications and patiently treating first one tonsil and then the other, alternating, with deep applications of the galvano-cautery, the tonsils were eventually brought down to normal size, without loss of a drop of blood and all his symptoms ceased.

It was perhaps a year later that I met the mother, and she looked so poorly that I hardly recognized her. Her story was that being troubled with hemorrhoids, she consulted a justly famous surgeon, who advised operation. He made light of her fears as to bleeding; and indeed when the operation was completed, he assured her that she had lost very little blood, and that her fears on that score were entirely groundless. Things went on in the usual way until the tenth day, when a most vigorous hemorrhage ensued, and she informs me that the surgeon remained all night at her bedside, and had much difficulty in checking the hemorrhage. Instead of leaving the hospital the next day as she had intended, she was there for many weeks, slowly recovering her strength from her exsanguinated condition. This case, by no means an isolated one, indicates the need for caution as regards bleeders, and that attention should be paid to the statements made by patients and further inquiries instituted as to the family history on that point.

In operating for lymphoid hypertrophies, and tonsils combined, the posterior nares should be cleared out first, as a rule, for if the tonsil be removed first the bleeding is so apt to obscure the field of operation that the lymphoid tissue is but partially removed, the operation being too hastily done, and there is also danger of injuring the soft parts, and the posterior pharyngeal wall. Not only that, but the wounded surface is very apt to bleed much more freely in the tonsillar regions from the manipulations, if the curette is used in the posterior nares subsequently. The ideal method is to remove the tonsils, then some days later, after the subsequent inflammation has entirely subsided, remove the adenoid vegetations. This unfortunately is but rarely done because of the objections on the part of the parents who refuse to allow the child to undergo two operations.

Regarding position during these operations when performed under anesthesia, my own preference is for that known as the Rose position, with the head well extended, or the one proposed by our fellow member Dr. C. R. Holmes of Cincinnati, with the patient lying on the side and the operator seated before the patient. The upright position has its advocates, but I, for my part, do not endorse it.

There is no doubt that the hemorrhage is decidedly less when these operations are done without narcosis, and in practically all instances it is indeed remarkable how promptly bleeding ceases.

Patients who have been operated upon under anesthesia are turned over on their faces, and allowed to drip for a few minutes, and returned to the bed immediately thereafter, and this period of quiet tends more to permit the vessels to contract, sealing up the wounds, than anything else; and hence, if for no other reason, patients who have been operated upon under anesthesia in the posterior nares and pharynx should not be allowed to walk about immediately thereafter. It is for this reason then that operations of this character should never be done in the physician's office or in public clinics, or where there are no facilities for rest and recuperation for at least six hours thereafter. In a large experience in public institutions it has been my invariable rule to insist that all such patients should remain over night at least.

I have found the use of a cold spray of some bland fluid like the Dobell's solution of value both during and after these operations together with the precaution to abstain from solid and hot foods, with the thought of preventing secondary hemorrhage. The use of an astringent gargle if practicable is advised.

For the bleeding, local applications of alum and tannin, in powder, and packing the posterior nares with gause, constant pressure on the bleeding point of the tonsil by means of the index finger of either hand or by means of specially devised instruments for that purpose, the deep searing of the parts with the galvano-cautery, the tying of the blood-vessels by means of the continuous suture run about the stump of the tonsil, and lastly the tying of the common carotid, are among the measures that may become necessary from the surgical standpoint. The internal administration of the Sulphide of calcium, the use of gelatine injected, or transfusion of normal salt solution, may also be mentioned in this connection.

Of the so-called bloodless tonsil operations the one with the cold wire snare is the safest. The galvano-cautery being followed by an immense slough, from which a brisk bleeding may readily occur, about the time the slough comes away.

Tonsillotomy in adults is quite a different thing from the same operation in children, the tonsil having become fibrous, and the vessels having lost their contractility. One is much more apt to be on the safe side, in performing any chosen form of operation in persons over sixteen years of age, to remove but one tonsil at a time, with an interval of about a fortnight between the two operations. I have seen a most distressing hemorrhage occur eight days after tonsillotomy, as also after galvano-cautery dissection, both in young men about thirty years of age. I have never had the misfortune to meet anything in the shape of hemorrhage following an operation of this character in a child.

In operations in the larynx, of an endo-laryngeal nature we are accustomed to use the cold snare and cutting forceps, quite freely, and I have failed to find a single recorded case of post operative hemorrhage in the larynx.

In the nose in the vast majority of cases requiring operation, the effect of adrenalin is most marked in rendering operations bloodless. This is especially so in the resection operation, when a few minims of the solution is injected under the mucosa prior to the operation. In the removal of turbinates and nasal polypi, it acts well in most instances.

For the radical operation in the accessory sinuses, entering the canine fossa, curetting the ethmoid, and entering the sphenoid, where the nasal wall of the antrum is removed and also the turbinates, the loss of blood is excessive, nor is this operation devoid of danger due to the possible laceration of the branch of the middle meningeal artery which lies directly in front of the sphenoidal sinus.

In order to avoid the distress accompanying the swallowing of large quantities of blood in the operation, the suggestion has been made to pack the posterior nares thoroughly before operating.

In all operations on the nose it is a cardinal rule with me to pack the nose in every single case, and to leave the packing in situ at least twenty-four hours, preferably forty-eight hours, the packing used being either Iodoform gauze or wool, or a strip of aseptic gauze thoroughly covered with Subnitrate of Bismuth.

To dismiss a patient thus operated with a solution of adrenalin and to use no packing, is to my mind to invite disaster, taking unnecessary risks. The long continued bleaching of the tissues from the adrenalin is also harmful, a slough sometime forming which, from its obstructive effect alone, is as disagreeable as any packing could be, and lasts for many days.

To the patient who objects to the packing of his nose after operation, as possibly rendering him uncomfortable, I am in the habit of stating that while he would be uncomfortable that night, that I would be exceedingly comfortable, for I will have the positive assurance that he will not need to send for me in great haste to control a hemorrhage that might otherwise arise. This argument is always convincing. After removal of the packing, or where no packing was used, it is always well to try to stem the flow of blood, with such measures as are at hand. Chief among these are Peroxide of Hydrogen, the Aceto-tartrate of Aluminum, etc.

I would say then in resumé:

That a family history of a tendency to bleed should receive our most serious and earnest consideration.

That Tonsillotomy in any person over seventeen years of age is not the simple operation that it is in the young.

That packing of the nose after operation is a safe guard against post-operative hemorrhage.

That the danger of hemorrhage is decidedly diminished if, in all cases where anesthesia is required, the patient be not permitted to be up and about, but be immediately put to bed and kept there some hours.

25 East 77th Street.

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## TUMORS OF THE MIDDLE EAR, WITH REPORT OF TWO RARE VARIETIES.

BY JOSEPH C. BECK, M.D., CHICAGO, ILLINOIS.

Tumors or new growths of the middle ear are not very extensively treated in most of our text-books, and aural polyps are usually the one growth that one finds described more extensively than any other, and not very much said as to the pathology, which is of some interest.

The various kinds of tumors that may arise from the middle ear are manifold, because all three embryonal layers are there represented, as the mesoblast, epiblast and hypoblast. Among the varieties of tumors that I have been able to find reported in literature arising primarily from the middle ear are the following:

### MALIGNANT.

Sarcoma, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10; Carcinoma, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35.

### MALIGNANT, MIXED.

Myxo-sarcoma, 11; Fibro-myxo-sarcoma cavernosum, 12; Melano-sarcoma alveolaris, 13; Osteosarcoma, 14, 15; Endothelioma, 36, 37, 38; Chloroma, 39; Angio-endothelioma.

### NON-MALIGNANT.

*Simple infectious granuloma:* Tuberculosis, 40, 44; Lupus, 45, 47; Syphilis, 48, 49; Actinomycosis, 50.

*Polyps:* Mucous polyps; Fibrous polyps, 51 and 52; Fibroma, 53, 69; Myxoma, 56; Osteoma, 57 to 65; Adenoma, 54, 71; Angioma, 55, 66, 67, 70; Psamoma, 102.

### MIXED NON-MALIGNANT.

Myxo-fibroma, 68; Angio-fibroma, 72; Chondro-adenoma, 73; Dermoid cyst, 74; Cysts, 75, 76, 77, 78, 79.

Cholesteatoma; doubted by many as a new growth, 80.

Various degenerations and changes in Polyps, 93. As fatty, 89; Chalky and bony, 94, 95; Cystic, 85, 86, 87; Glandular, 82, 83, 84; Hemorrhage, 88; Cholesteatoma, 81, 96; Abscess ulceration in polyp, 90; Atrophy, 91, 92.

Gruenert<sup>97</sup>, says that Bruehl<sup>98</sup> and Goerke<sup>99</sup> have the proper idea as to classification and pathological diagnoses of tumors of the middle ear, which is briefly as follows:

1. Malignant: Sarcoma and carcinoma.
2. Non-malignant: Mucous and fibrous polyps.

All the other varieties that are mentioned by other authors are nothing more or less than changes going on in the various component parts of the polyp, says Goerke. For instance, fibro-angioma is an increase in the fibrous tissue and blood vessels, and new formation of the same. An adenoma is a tumor in which the lymphoid cells and other glandular structures predominate, etc. A pure myxoma, such as one finds in the nose, he denies, and says it never occurs in the ear primarily, proven by several hundred microscopical examinations of ear polyps. These views are not held, however, by all authors, as Moos and Steinbrügge<sup>100</sup> have found four cases of pure myxomata in the middle ear. Weidner<sup>101</sup> has seen an angioma of the middle ear in which he demonstrated the newly formed blood vessel.

I have brought with me specimens of ear polyps which show distinctly, first, new formations of endothelia and blood vessels, without any inflammatory condition, and, second, a true myxoma, which might show that Goerke's deductions, though highly authentic, need not necessarily be correct. Again, the clinical picture of this case of angio-endothelioma is so different from ordinary cases of ear polyp that I may be excused for bringing it before you, and reporting it as rare. In fact, it is the only case of that variety on record, so far as I have been able to find in the literature.

*Case 1.* Mrs. Enda M., aged 23, married; one healthy child.

*Family history:* Negative, except that her sister had her tonsils removed at the age of 21, which was followed by such excessive hemorrhage as to necessitate transportation to the hospital, and ligation of the carotid artery. (I have seen the patient.)

*Childhood history:* Measles, whooping cough, mumps. Tonsillitis from the second to the eleventh year. At this age tonsils were removed, with little bleeding. Diphtheria at fourteen. Acute bronchitis at sixteen, followed by neuritis of the left side of the arm. At the age of nineteen, she noticed some deafness in her left ear, with slight pain; also a frontal headache. Consulting a physician, she was told she had catarrh. He irrigated her ears, and the patient declared after that she heard better, but a marked noise developed



distinctly simultaneously with her heart beat, which continued for two years, when she consulted Dr. Cartwright, of Chicago, who told her that she had a tumor in her left ear, and sent patient to me.

*Additional history:* She had never any discharge from her ears, so far as she knew. There is no specific history to be obtained.

*Examination:* Hearing, right, V. S. normal: watch, 30 inches; fork, high and low; whistle, complete scale. Left, V. S. 1 foot; watch, contact; fork, hears both; whistle, some of the lower tones not heard so well. Rinné,—. Weber, < L.

Nose and throat: comparatively negative.

The right ear: normal. Left ear: A growth fills up the whole canal and can be easily seen at the outer meatus. It has a bluish-gray appearance; is not painful on pressure: covered by a thick layer of epithelium. On trying to see where the attachment of the pedicle may be by means of a blunt-pointed probe, I found this to be extremely painful, and followed by free bleeding.

*Diagnosis:* Aural polyp of unknown nature. I recommended its removal, to which the patient consented.

Using a local anesthetic, as cocaine, menthol, carbolic acid, full strength, in equal parts, and strong solutions of cocaine, I found it impossible to proceed with the operation, owing to the hypersensitiveness of the parts, and consequently recommended her to take a general anesthetic, which she also consented to do. This was done two days later, the patient being properly prepared in the meantime, a further examination as to her general condition finding her normal in every part of the body, except for some laceration of the cervix and perineum, which had followed childbirth. The urine analysis was negative.

*Operation:* December 3, 1904. A blunt-pointed probe found the growth to be firmly attached anteriorly about a half an inch from the external auditory meatus. Bleeding following this procedure was profuse and uncontrollable. I applied Blake's polyp snare as rapidly as possible, and removed a part of the tumor about the size of a pea. This was followed by hemorrhage such as one gets in opening the jugular or the lateral sinus. I wish to make this one point of interest in connection with the pathology of this growth. I was unable to continue the removal of any more of the tumor, because after several attempts of compression and various other means to stop the hemorrhage, I was unable to do so. Fresh violent bleeding would occur. I then packed the ear firmly, by the aid of

external compression stopped the hemorrhage, and placed the patient in bed.

The microscopic examination of specimen made by Dr. Evans, of the Columbus Laboratories, showed it to be a very vascular tumor, with many small cells, possibly sarcoma. However, the statement was made by Dr. Evans that the vessels showed a more firm condition than one finds in a sarcoma.

The patient's condition following the operation was: temperature, pulse and general condition normal; but a slight facial paralysis was seen on the left side, which I accounted for by the firm compression that was necessary to stop the bleeding. The bleeding, while not so violent as at the time of the operation, occurred at each dressing, until after about a week, when cicatrization of the stump took place. The facial paralysis gradually disappeared.

In view of the microscopic examination, I made a proposition to the patient to do a radical operation, to which she consented, and re-entered the hospital about a month later. During this time Dr. Henry Wagner, of San Francisco, being in Chicago, saw the case, concurred in the diagnosis and indications, and suggested the use of gelatine foods preliminary to the operation, as he said he had success in lessening thereby the tendency to bleeding in similar conditions. I mention this incidentally to show that it had no effect in the operation which followed.

*Radical operation:* July 21, 1905, under general anesthesia, the radical operation was performed, with very little difference in the steps from that performed in cases of chronic suppuration of the middle ear. I was very careful not to open into the membranous portion of the external auditory canal until I had removed enough bone, owing to the bleeding that I anticipated would follow this procedure and obscure the field of operation.

Again, I would like to make the point about the bleeding tendency of this patient, in that from the moment the skin was cut back of the auricle, there was constant, uncontrollable oozing from every cut in skin and bone. There was no evidence of disease in the cell of the mastoid; in fact, everything appeared normal, until I removed the external wall of the aditus, and the bridge before reaching the attic. I then rapidly slit the membraneous canal and exposed the growth, which measured about half an inch in length, and one-fourth of an inch in thickness, being attached to the anterior wall of the middle ear and not to the external auditory canal, as said before. I was particular to see if there was any abrasion in the

course of the external auditory canal, and found none. With a dull scoop I delivered the tumor, and Dr. Wagner, who examined it, declared at once that it was encapsulated. I thoroughly scraped the surface where the tumor had been attached, completed the operation, draining in both directions. The patient made an uneventful recovery, with a very protracted healing of the posterior opening. It would bleed frequently, and was extremely sensitive.

Microscopic examination of the tumor removed, made by Dr. Evans, of the Columbus Medical Laboratories, showed numerous blood vessels, which are filled with distinct endothelial cells. Many of these vessels seem to be broken, and the same kind of cells (endothelial) are dispersed within the stroma. There is a distinct layer of epithelium covering the tumor, but none of the epithelial cells penetrate below their normal stratum. There is no inflammatory reaction, except at that portion of the tumor where the first part had been severed, and that limited purely to the borders. No other structure can be made out in the specimen.

Endotheliomata are classed, according to Senn, Warren, and Thielmann, among the sarcomatous structures, and are malignant. Angiomata are non-malignant tumors, and made up of newly formed blood vessels.

Owing to the imperfect closure of the posterior opening and slight retention place in the external auditory canal of this patient, I decided to complete the plastic operation, and therefore gave a third anesthetic in August, 1905, curetted the middle ear, and made microscopic examination of the scrapings. I found no evidence of any endotheliomatous structure.

#### CONCLUSIONS.

1. The great similarity of this case to a malignant growth, both clinically and pathologically, was responsible for my doing the radical operation.
2. Other tumors besides inflammatory may arise in the middle ear.
3. That there may be a possible relation between the bleeding tendency (hemophilia) and the growth of this tumor, the history of free bleeding of the patient and her sister would be suggestive.

*Case 2.* True myxoma of the middle ear. I merely wish to place this case on record, because I was of the opinion that this condition was a common one, until I looked up the literature in connection with tumors of the middle ear. Goerke makes the state-

ment that he has never found such a condition in the many hundred sections of ear tumors examined, and other men state that this condition is very rare. I will not read the complete history of the case, but simply say that the diagnosis was a polypoid growth of the middle ear. There is nothing of interest in the clinical phase of this case, and the course was that of an ordinary ear polyp. The microscopic slides are here for your examination. The diagnosis was verified by the examination of Dr. Evans, of the Columbus Medical Laboratory.

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#### DISCUSSION OF PAPERS OF DRS. MAYER AND BECK.

DR. GOLDSTEIN: The paper of Dr. Mayer developed so many points of practical value that the short time allotted for the further discussion of our work this evening, is not sufficient to do it justice. I really believe that if we could take up and carry out every practical suggestion in all the work that we do in the nasal and naso-pharyngeal operative field that Dr. Mayer brings out in his paper, we should be decidedly at an advantage so far as the after-treatment of our patients is concerned. The two points that appeal to me as of most importance are, in the first place, the requirement that the patient rest after an operation, even of minor consideration. It strikes me that is a valuable point and a matter that I hope to carry out perhaps a little more regularly than I have in the past. The other is the question which has been raised on the floor of the Academy on various occasions, where there is considerable difference of opinion among the operators, and that is, whether or not to pack after an intra-nasal operation. Personally I am entirely in accord with the suggestions of Dr. Mayer. I believe in the pack after nasal operation. I believe that the essential points of value for this pack are the control of the hemorrhage or subsequent secondary hemorrhage, and in any of those selected cases in which we may

still require the use of the galvano-cautery (and some of us still use that instrument on selected cases), the prevention of synechia in the healing of the wound; and thirdly the value of having your mucosa in close apposition after septum operation. I understand even that some operators are in the habit in the newly developed sub-mucous septum operation, of leaving one side, the side opposite to the operative field, without a pack. I believe the justification of a pack is made in the pressure, the equalization of the pressure on either side of the septal area. So all in all, the practical points of the paper bear considerable observation, and I am sure many of us regard them as of importance. Dr. Beck's paper is certainly a valuable adjunct; a valuable addition to our literature on the subject, and presents a very complete clinical report.

DR. STEIN: The report of Dr. Beck's case brings out several very interesting features, particularly as to the teachings of authorities on observed malignant growths of various kinds, which is to the effect that primary involvement of the middle ear is rare. The case reported by Dr. Beck is unusually rare. When we have an involvement of the middle ear by such growths, they are usually secondary; that is they are growths that invade the middle ear cavity from the base of the skull, or the region surrounding the ear, from the parotid, or nasopharynx, or the antrum, or more frequently the auricle and the auditory canal. This case apparently had its origin in the middle ear. I should judge, or probably just external to that, in the end of the canal. Another feature of this case which is of particular interest clinically, is the great variance from the teaching usually given to us, relative to such growths. We ordinarily look, in such cases, for the history of considerable pain and repeated hemorrhages, discharge, extreme sensitiveness of the ear, or of the mass; but none of these symptoms seemed to be present in this case, at least not in the early history of the case. Therefore it is only natural that one should make a diagnosis of aural polypus, as Dr. Beck did, and not expect any malignant condition until later. If it had its origin in the middle ear and was not associated with any form of middle ear disease, it makes it all the more rare and unique because the authorities show that most all these growths are associated with some chronic suppurative middle ear disease.

DR. BALDWIN: Just two points that have not been mentioned. They seem very homely, but as they have served me so well, I think they may serve others. My attention was called to the ad-

ministration of the tincture of chloride of iron before operations. It really seems to lessen the hemorrhage. It is well to continue its administration for a few days after the operation. Where one must pack for post-operative hemorrhage, I would mention the use of a strip of smoked fat ham or bacon. This was used years and years ago, but has fallen into disuse. I think it saved the life of one of my patients. You can cut it from the inside of a piece of meat and if you wish, soak it in some antiseptic solution. In some cases where good resulted from its use, it was thought necessary to remove it in from twelve to twenty-four hours, and the bleeding recurred. You may have bleeding so profuse that you must hold the packing in with one pair of forceps while you pack with another. Leave it in forty-eight hours or longer. It will become practically digested at the end of that time and you have nothing but a little skinny substance left, the oil having been cared for by the tissues. I am quite sure that in some desperate case you may find it worth remembering. Everything else had been tried in my case, and the man would have died if it had not been used.

DR. BALLENGER: I wish to narrate an incident that once occurred to me with the Peter's snare, which at that time probably was one of the best heavy snares on the market, and one which I used in many cases, up to the last four or five years, since which time I have not used a snare in my operations. I removed a pair of tonsils from an adult, and about two hours after the operation the patient began to bleed. In the meantime, I had left my office, going to the hospitals and finally to my home, and it was as much as eight or nine hours before they could get me by telephone. The patient had been bleeding most of this time. It took me another hour to reach the patient's bedside, and when I had arrived, I found he had stopped bleeding. He had been bleeding all told eight or nine hours. They had in the meantime called in a local physician, and he had done the best he could with the patient, but without success, apparently. The patient was so much exsanguinated, that it was two weeks before he could leave his bed. That is the worst experience I have had with the snare, which previously I had looked upon as the means of bloodless removal of the tonsils. Since that time, I have been a little afraid of bloodless methods; that is, I have doubted rather, the existence of the bloodless method of removing tonsils.

As to the other points in the paper, I am in the main, in general accord with Dr. Mayer's conclusions. I do not, however, like as well as he does, the idea of packing the nose after nasal operations.



If I do not expect a hemorrhage, or if I have no mechanical reasons for packing, as we do have in the sub-mucous operations where we must have apposition of the mucous membranes in order to prevent haematoma, I like to avoid a dressing unless I have a special reason for using it. In other words, the nasal cavity is an infected area in spite of all we may do, and I believe the open method is better than the method which leaves it subject to the retained secretions that must follow the introduction of a nasal dressing. When I wish to leave a nasal dressing in place for twenty-four, forty-eight or seventy-two hours, I employ either the sub-nitrate of bismuth gauze, or I saturate the gauze with a solution of the compound tincture of benzoin, squeezing out the excess of fluid, and packing the nose with this preparation. By so doing we find that when the gauze is removed at the end of seventy-eight hours there is no odor, and the wound is comparatively clean. I think that is one of the safest means of dressing a nose that I know of as far as infection is concerned. I have left the gauze in place in the antrum for eight or nine days and removed it at the end of that time and found it perfectly sweet.

DR. BLAAUM: It has been shown that bleeding after tonsillotomy is very often the consequence of a removal of a part of the posterior fold. Therefore it would be wise to make an examination after the removal. I believe there is no doubt that very many of the post-operative hemorrhages are due to a lesion of the posterior fold.

DR. ROBERTSON: Dr. Mayer said he had secondary hemorrhage, but I think the term has been misused. Secondary hemorrhage does not come a few hours after an operation. This is late primary hemorrhage. Secondary hemorrhage is after a slough.

As a dressing for the nose if packing is to be avoided, a great many are now using collodion. To dry the tissue you use the adrenalin. Dry thoroughly and paint with three or four coats of collodion. I always pack nasal cases, and I pack them with sterile gauze saturated with sterile or medicated vaseline. I have seen and used all the gauzes that have been advocated and I have never seen anything that suits me as well as that. It slips out easily, does not stick to the tissue, and the only thing about it that is disadvantageous, is that the secretions of the nose decompose more readily than they do with some of the other packing. You cannot leave it in more than thirty-six hours.

In regard to tonsil hemorrhage, that comes in my opinion, not from any particular operation; it comes from an incomplete removal of the tonsil. It comes from the fact that you cut away part of the tonsil, and leave, as Dr. Mayer suggested in his paper, a tonsil that is involved in cicatricial tissue. As soon as you cut the tonsil out so completely that you get into the soft connective tissue, then your hemorrhage stops.

DR. SPOHN: The paper of Dr. Mayer was especially practical. Dr. Beck's is practical also, but we do not come in contact with that subject quite so often. It seems to me that these cases of hemorrhages occur because the tonsillotomies are not thorough, but I cannot understand how one can do a great number of operations day in and day out and not have any hemorrhages. I make it a rule always to paint over the surface of the faucial region, if that be the region involved, with a sixty or eighty grain solution of nitrate of silver, and that seeping is nearly always stopped in those cases. There is another little point. If a man does his operation in the country and has not his instruments and paraphernalia, he is often in a position where he cannot very well stop the hemorrhage. I was caught in such a position at one time and I resorted to the old, old method of vinegar inhalations, and I thought it was probably due to the styptic action of the vinegar, but after working with a number of other cases, I find it is due to the mechanical action of the breathing, by taking long, deep respirations. We get an action of the muscles which closes the blood vessels.

DR. BERNSTEIN: Just a little point I wish to make, which was given to me by an old practitioner, that is after tonsil operation to rub the surface with turpentine. It is an old-fashioned remedy, but it acts wonderfully well. It reduces after-swelling, and in a measure controls hemorrhage. The subject of calcium-chloride used internally has been mentioned. I have had cases of internal hemorrhage and have used this calcium-chloride with satisfactory results.

DR. MAYER (closing): I will take but a moment, and say but a word. If in the experience of your associates, for whose opinion you have respect, there is a possible element of danger of your patient having a secondary hemorrhage, and if no harm can come from packing, why not pack?

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## ACUTE EUSTACHIAN SALPINGITIS.

BY FRANK H. KOYLE, M.D., HORNELLSVILLE, N. Y.

The aetiology of Acute Eustachian Salpingitis is to be considered under two heads: predisposing and exciting. The chief *predisposing* causes are: impaired general health, disordered gastric or intestinal digestion, pre-existing lesions of the nose and naso-pharynx, adenoids, middle ear catarrh, hypertrophy of the faucial tonsils, rickets, gout, lithaemia, hot and insufficiently ventilated rooms, improper dressing, and failure in the use of ordinary judgment in eating, drinking, bathing and exercise.

Among the more common *exciting* causes are to be found: acute coryza, acute naso-pharyngitis, acute pharyngitis, diphtheria, typhoid fever, hay fever (so-called), pertussis, the exanthemata, damp underwear, and chilling of the cutaneous surfaces.

Among the less common *exciting* causes are: acute articular rheumatism, syphilis, the accidental introduction into the Eustachian tube of either fluid or solid bodies, external injury or that due to the passage of bougies, nasal sepsis, and again adenoids.

In his work on Diseases of the Ear, Gruber makes the statement that "pathological changes peculiar to the organ of hearing have no existence; and that there can be, therefore, no justification at all for any *special* pathology of the ear." He further states that "As, however, the most diverse tissue-elements contribute towards its formation, and diseases of the neighboring structures exercise great influence upon its function, an accurate acquaintance with such diseases must be gained. The fact also that the ear is not rarely affected by diseases of organs standing in no direct anatomical connection with it, emphasizes the need for a familiar acquaintance with general pathology." While these statements are perfectly true as comprising a general enunciation, it is more the habit of the American mind to proceed from the general to the particular. Because of tubal continuity it would not be considered *quite* the right thing to give the pathology of proctitis if one should be asked for that of gastro-duodenitis. The gall-bladder and labyrinth both contain fluid, yet no one will contend that the most perfect knowledge of gall-stones will help in assigning a cause to a vertigo. If, then,

we are to consider the Eustachian tube as an entity, even though it be a part of another organ, we must consider it as such and give to it the consideration which so important a structure deserves.

The mucous membrane of the normal tube is lined with cylindrical epithelium except in its cartilaginous portion where the epithelium becomes ciliated, the direction of the ciliary movement being towards the pharynx. Salpingitis in its mildest form may be a simple hyperaemia of the mucous membrane of the tube: or, a mild inflammation may follow the venous engorgement, attended by a slight swelling and diminution of the tubal lumen. With the involvement of the submucous layer the increased pressure results in a more or less complete stenosis and in a transudation of the fluid elements of the blood, the viscid exudate containing quantities of ciliated epithelial cells and leucocytes. Plugs of mucus of varying consistency sometimes occupy the lumen of the entire tube, although the occlusion caused by these masses is more often found in the cartilaginous tube. The gland-follicles are engorged and enlarged, giving a granular appearance to the tubal lips. Other pathological conditions to be considered are those of the middle ear resulting from the tubal stenosis. Here the rapid absorption of the contained air results in a diminished atmospheric pressure, while the same force acting from without drives the drum inwards and with it the ossicular chain. Should this condition remain unrelieved, adhesions form between the promontory and the membrana tympani at its point of least resistance.

The symptoms of Acute Eustachian Salpingitis vary in degree with the intensity of the attack. If mild, the affected ear becomes suddenly stuffy and stopped-up. To relieve the sensation of occlusion, the patient resorts to various devices such as exhausting the air in the auditory canal with his finger, swallowing, yawning, and a lateral movement of the jaw. Not infrequently there will be experienced a stiff, numb sensation involving the whole side of the head. Should the tubal stenosis last more than a few hours deafness and tinnitus aurium, varying in intensity according to the severity and duration of the attack, will almost invariably be present. The subjective sounds may be out of all proportion to the deafness, no complaint of which may be made by the patient, and consist of high-pitched, singing or squeaking noises. Sensations of pain are usually complained of, referred to the upper part of the pharynx, the larynx, the root of the tongue, to the tonsil and radiating to the ear, and to the side of the neck over the course of the tube. Instead of pain there may exist a sensation of a foreign body in the pharynx or

larynx or at the root of the tongue. Another symptom nearly always complained of is autophony. In those cases where the inward displacement of the membrana tympani and ossicles is very pronounced vertigo is quite apt to obtain, and in cases which have resisted treatment for some time aprosexia is not uncommon.

In making a diagnosis it may be well to suggest the importance of avoiding the error into which a young aurist will sometimes fall, viz.: the immediate reduction of the inflamed nasal tissues, a condition obtaining in most cases of acute Eustachian salpingitis. Such reduction should never be made until the rhinoscopic mirror has been used and the M. T. inspected.

The nasal mucous membrane will be found more or less acutely congested, boggy with a watery infiltration, turgescient, and the passage more or less occluded. In most cases there will be marked fullness, perhaps redness, of the faucial tissues, and occasionally a mild oedema of the soft palate and uvula. The rhinoscopic mirror will show a pronounced congestion of the tubo-pharyngeal eminence with more or less closure of the tubal entrance. An exudate of varying consistency will frequently occupy the tubal orifice in severe cases which have remained untreated for several days. If adenoids are present they will be swollen and congested, with stringy mucus occupying the interstices between the masses. If lymphoid tissue is not present the naso-pharyngeal vault will be congested and dry, or moist, according to the stage of the disease.

On inspecting the M. T. it will be noticed that the whole lower two-thirds of the membrane is greatly sunken and the cone of light displaced. This displacement will vary according to the degree to which the drum is indrawn. If the retraction be absolute the cone of light may be absent altogether; if only partial, the light reflex will be seen occupying a position somewhat higher than the normal. The malleus handle will be seen foreshortened, its tip being in more or less close apposition to the internal tympanic wall. In severe cases the neck of the malleus will be outlined by the closely clinging drum membrane, the short process being projected outward as a well-defined white knob. The anterior fold of the M. T. will usually look stretched and wrinkled, the posterior fold exaggerated, and the whole membrana vibrans so thin that through it may be seen the lining membrane of the uncongested inner tympanic wall, together with parts of the incus and stapes. As Dench so tersely puts it, "the physical appearances are due entirely to the diminution of atmospheric pressure within the tympanic cavity, this region itself being unaffected."

If the surgeon desires to be thorough in his diagnosis he will now proceed to make a functional examination of the aural conditions obtaining in his patient. After finding that hearing is reduced for the watch, acoumeter, and residual whisper, a condition which he naturally expects to encounter, he is now confronted by such positive evidence of labyrinthine disease (a marked reduction of the upper tone limit), that, engrossed by this new turn of affairs, he is apt to lose sight, for the moment, of the physical conditions which have already enabled him, probably, to determine the character of the disease under investigation. Should he ask himself at this juncture whether this is an "error of the mind" or an actual labyrinthine lesion, he will see, after a moment's consideration, that the lesion is not only real but the only condition that could be expected, from a mechanical point of view, as a result of the profound displacement of the ossicular chain. He now understands that the tinnitus, and perhaps vertigo, of which the patient has complained is due to the inward excursion of the stapedial footplate which has pressed upon the endolymph and violated the sanctity and integrity of the delicate structures guarded and bathed by the labyrinthine fluid. If the labyrinthine disturbance is, however, of less degree, it will usually be found, in a well-defined case under 40 or 45 years of age, that there is a raising of the lower and a lowering of the upper tone limits, the degree of each depending upon the acuteness and severity of the attack, as well as upon the length of time the disease has existed and the extent of the stapedial incursion. Rinne will be found negative for the lower notes, usually up to C natural, and then a reduced positive, varying to positive according to the degree of pressure. If the disease is unilateral Weber will be found positive.

The tuning-fork tests will be of less value, however, in patients over 45 years of age owing to the altered conditions of bone-conduction which then obtain. Another exception to be noted is that due to hyperaesthesia of the auditory nerve, which, according to Dench, may be produced by a sudden increase of labyrinthine pressure in sudden and complete closure of the tube. This author claims that "when the auditory nerve is in a condition of hyperaesthesia the perception of low tones is well preserved, and it may happen that the lower tone limit is not elevated to the degree which we should expect to find in sudden and complete closure of the Eustachian tube."

Acute Eustachian Salpingitis is to be differentiated from (a) Acute Tubo-Tympanic Congestion, and (b) Acute Otitis Media, the

history of the case and the physical conditions obtaining in the nose, naso-pharynx and tube, together with the appearance of the M. T. precluding any possibility of mistaking the affection for acute labyrinthine disease.

In Acute Tubo-Tympanic Congestion the patient complains of pain rather than the stuffy feeling experienced in acute salpingitis. There is impairment of audition but it is not so pronounced nor so sudden in its onset as in salpingitis. Again, there is usually a small amount of fluid in the middle ear cavity, air-bubbles being seen through the drum membrane on auto or other inflation, the air producing a crackling sound as it passes through the fluid. The M. T. is either a dull white or a pinkish white, the inferior segment showing a yellowish tinge if serum is present in the middle ear, and is only slightly retracted. The malleus handle is only moderately foreshortened and is somewhat rendered.

The findings of the functional examination are practically those of acute salpingitis and are thus of no value from a differential point of view.

In Acute Catarrhal Otitis Media there is at first a sensation of fullness and stuffiness in the ear, but this rapidly changes to a steadily increasing pain which ultimately becomes so severe that the patient complains of practically nothing else, even of the subjective noises which may be present. The diffused, pronounced redness of the M. T., together with the pain referred to, makes the diagnosis of this disease easily differentiated from that of Acute Eustachian Salpingitis.

Some authorities are prone to consider an attack of acute Eustachian salpingitis as of slight importance; others do not even mention it. It is true that a properly handled initial attack is devoid of special danger to the integrity of the ear, but it cannot be too forcibly impressed upon the patient that one attack predisposes him to another, a second to a third, a recurrence being certain if the disease is allowed to run its course and ultimately resulting in a permanent impairment of audition. It will not suffice that the patient may not be conscious, at the expiration of a few days of treatment, that he has any impairment of hearing. He must nevertheless be told, and in no compromising terms, that it will take several weeks to permanently restore the function of the ear. The constant dropping of water will wear away a stone. Likewise the stretching process to which the M. T. is subjected during each attack of acute Eustachian Salpingitis will deprive it of its elasticity to such an extent that it will stay stretched. The tensor tympani muscle, deprived of its

normal function as a result of its drifted anchorage, will become shortened, while the apposition of the tip of the malleus to the intratympanic wall will result in adhesive inflammation, the irritation thus produced involving the whole middle ear cavity in a chronic inflammation.

Treatment of Acute Eustachian Salpingitis includes the management of the present attack, attention to the exciting causes of the present attack, predisposing causes, and the prevention of recurrence of the disease. Since the opening of the Eustachian tube is to be accomplished before hearing can be restored, we must, if we are to use the catheter, not only reduce the engorged tissues but anaesthetize them sufficiently to make the operation painless. For this purpose a spray or swab of cocaine or eucaine must be used to open the nasal passages and the mouth of the tube. If the swelling is persistent adrenalin solution, applied either alone or added to the anaesthetic, will produce immediate ischaemia and shrinking of the parts. The nose is now sprayed gently but thoroughly with a warm alkaline antiseptic, *e. g.* a 20% solution of Glyco-Thymoline. The naso-pharynx should then be thoroughly cleared of its viscid secretions. This is accomplished, first by means of a single-tube DeVilbiss atomizer introduced through the inferior meatus; then by a post-nasal spray, using the double-tube DeVilbiss atomizer with reversible tip, the soft palate being gently retracted to facilitate the cleansing. This method is preferable to the use of the post-nasal syringe and will not, if care is used, produce the traumatism of the palate and pharyngeal walls which is more than apt to follow the use of the syringe. At this stage of the treatment it is frequently difficult, sometimes impossible, to use the rhinoscopic mirror for the purpose of further inspecting the condition of the tubal orifice. Should it be possible, and the tubal orifice is found occluded by a plug of mucus, it is best to remove it thoroughly before attempting inflation. The mouth of the tube being anaesthetized, a cotton-tipped applicator suitably bent and moistened with a 10% solution of alumnol may be used to detach and wipe away the mucus. Should inspection be impossible, the catheter, gently introduced, will prove to be the best means of ascertaining the presence of mucus. Using the Dench apparatus, a gentle pressure of the bulb will produce coarse, rasping, bubbling sounds if thin or stringy mucus occupies the meatus or the canal itself. If the mucus be inspissated the impinging of the end of the catheter against it will prevent egress of air and no sound will be heard. To be sure that an oedema is not the cause of the obstruction, the tip



should be moved about gently while slight pressure is being applied to the bulb. If it is determined that the obstruction is due to a plug of inspissated mucus it may be removed in the manner already mentioned. If, on the other hand, fluid mucus is found, the catheter is left in position, the inflating apparatus detached from it and *gentle suction* used. Almost invariably it will be found that the mucus can be easily sucked into the catheter from which it can be forced, after withdrawal from the nose, by a blast of compressed air and received upon a bit of cotton or paper for preservation and future examination. So long as fluid mucus is found in the tube this procedure should be kept up, the introduction of the catheter, its withdrawal, and the management of its tip being conducted with the greatest care. Even a plug of gelatinous mucus lodged in the isthmus can thus be removed, the suction engaging it in the distal end of the catheter where the mass will be found on withdrawal. It has frequently been the writer's good fortune to so completely remove in this way the viscid mucous and muco-purulent secretions of the tube that the subsequent catheterization was a dream, a mild inflation serving to restore normal tympanic relations without producing, or increasing an existing, tinnitus or vertigo. It might be added that he has employed the same method with equal success in withdrawing comparatively large quantities of fluid from the cavity of the middle ear in tubo-tympanic congestion. Having now cleared the tube by means of the catheter it would be folly to substitute for it the Politzer bag to complete the inflation.

From the first the object has been to relieve the patient's deafness. This can be accomplished by only two methods, viz.: the Eustachian catheter, and Politzerization (or one of its equivalents). The great value of the former in the preliminary clearing of the tube having been so clearly demonstrated, the writer believes that the latter should be condemned except in the treatment of young children. True, it gives quick results, if, indeed, inflation is possible at all, but it is nevertheless true that the operation is always fraught with danger. During its performance the contents of the tube must necessarily be driven into the cavity of the middle ear. It is difficult, nay, impossible to accurately regulate the force required to open the tube, and hence a possibly infective mass is distributed broadcast within the tympanic cavity, while the impact of the blast of air cannot but produce a traumatism of the inflamed and contracted tubal walls and of the delicate middle ear structures. It is in this way, too, as instanced by increased tinnitus and vertigo, that more or less damage is done to the labyrinthine contents as the result of sudden

shock and pressure. It does not seem fair to subject a patient to the possible untoward results of such a forcible inflation by Politzerization. Enumerated, these are found to include: acute suppurative otitis media with its possible sequelae; chronic adhesive catarrhal otitis media; impaired integrity of the stapedius and tensor tympani muscles; stretching of an already weakened drum membrane, thus producing unequal vibrating areas should it have become adherent to the promontory; damage to the opposite ear either from trauma or infection or both; and last but not least, a permanent injury to Corti's rods or the membrana basilaris.

The writer feels warranted in making the statement that the first-mentioned of these results is only too common, an acute salpingitis being converted into an acute suppurative otitis media through the injudicious means taken to rapidly give the patient relief. Children too young to be amenable to catheterization must, of course, be Politzerized; but even in them we must realize that many a case of acute or chronic suppurative otitis media was primarily one of acute Eustachian salpingitis. As to the second of these results, viz.: chronic adhesive catarrhal otitis media, it may be said that non-infective viscid secretions or exudates thus driven into the cavity of the tympanum are not completely absorbable. The aqueous element having been absorbed, what becomes of the sticky residuum? Assuming its innocuousness, it is nevertheless a mechanical menace to the normal transmission and reception of external vibrations. Surrounding the ossicles and their articulations, reducing the mobilization of the stapedial foot-plate by its very adhesiveness, diminishing by its contracting force and by its weight the outward excursion of the membrane of the round window, an excursion so necessary to labyrinthine equilibrium, this residuum ultimately becomes organized into a low grade tissue and a pathological condition now obtains in which an insistent, insidious process of inflammation adds new material to the recently organized exudate. Thus the foregoing physical conditions are exaggerated and the transmission of sound more and more impeded by subsequent repeated accretions and contractions incidental to the now chronic hyperplasia. The writer's objection to Politzerization as a routine primary procedure is so pronounced that it has seemed necessary to establish his position by thus reviewing its probable consequences. In so doing he is entirely cognizant of the fact that several authorities advise Politzerization in the treatment of this disease. In fact one of them, Bishop, goes so far as to emphatically advise against the use of the catheter, claiming that "it increases the irritation of the inflamed tube." If

it were always possible to see and treat these cases at their very inception and with the tube perfectly dry, it is quite probable that no material harm would result from the "gentle and gradual Politzerization" which he advises, but in the writer's experience these cases have never presented themselves until the process was well established. Having decided, then, upon the use of the silver catheter, it is only necessary to say that the actual induction of the restoration of the tympanic membrane to its normal position should be proceeded with in a manner so cautious and gentle as not to produce the slightest traumatism of the tube, the drum membrane, the intra-tympanic structures or the labyrinth. Thus tinnitus and vertigo are relieved by the gradual release from pressure of the labyrinthine fluid, the intra-tympanic muscles allowed to functionate normally, the drum membrane and ossicles restored to their proper relations to one another and to adjacent structures, and more or less normal hearing ensues. It occasionally happens that with no inspissated plug of mucus occluding the tube the constriction due to oedema or engorgement is so great as to make it impossible to perform inflation by *any* method. Should this condition be present it will be found that a Dench bougie of No. 5 piano wire, tipped with a small pledget of cotton, will serve a useful purpose if moistened with a 1-1000 adrenalin solution, introduced through the catheter and gently pressed against the engorged tissues. In about a minute inflation can be performed, especially if the patient be directed to swallow at the same moment the bulb is compressed. It is in these cases of total obstruction that the greatest caution should be used in inflation, since the introduction of even the smallest stream of air under moderate compression of the bulb will not infrequently increase the existing labyrinthine pressure and produce a severe vertigo, great nausea and vomiting, and a collapse from which it takes hours to recover. For this reason it is advisable to so regulate the force of the entering stream of air that it will merely *trickle* in, thus providing for the gradual restoration of labyrinthine equilibrium while abolishing the intra-tympanic vacuum. Inflation having been satisfactorily performed, an astringent is to be applied to the mouth of the tube with a cotton-tipped carrier. Argyrol in a solution varying in strength according to the severity of the inflammation (*i. e.* from 20% to 50%) will furnish an ideal medicament. The act of swallowing will now aid in the distribution of the argyrol throughout the tube in so thin a stratum as not to materially lessen its lumen and will exert its astringent action for some hours. If the nasopharyngeal process has been an acute one a 50% solution of the same

medicine is then painted over the entire naso-pharynx as well as over the oro-pharynx and tonsillar regions should they present evidence of inflammation. A 5% solution may even be sprayed into the nose if the surgeon will remember to caution his patient to use a 1-1000 solution of bichloride to decolorize the stains on subsequently used handkerchiefs.

It has usually been considered necessary to instruct the patient to use various aqueous or oil sprays and medicated vapors containing a variety of drugs such as tinct. benzoin comp., carbolic acid, menthol, camphor, iodine, eucalyptus and other oils. While the inhalation of a warm, bland vapor from a sterilized petroleum product into which a *very small* quantity of one of these drugs has been incorporated may be ordered for home treatment, it is doubtful if any particular benefit, except moral, is derived from its use in *acute* cases. Practically all these drugs are too stimulating, even in weak solutions, to be used on an acutely inflamed membrane. Later on, if the disease has not succumbed to astringent and detergent or other treatment, it is good medicine to promote endosmosis by vascularizing the atonic submucous tissues with one or more of the above-mentioned stimulants. It is then, and only then, that the introduction of such a vapor into the nose and Eustachian tubes can be productive of any real good. Instead of a warm vapor the writer has found that the use of superheated air has been of benefit in certain cases which did not prove amenable to other treatment. The temperature required is that of the patient's toleration, care being used to avoid destruction of the nasal mucous membrane. A fibre catheter is the ideal instrument for this purpose, but a silver catheter wound with a strip of compressed cotton may be used. An air pressure of ten pounds through an appropriate heating apparatus will generally prove sufficient to take care of the moisture in the tube and will not force mucus into the middle ear cavity. It is not to be assumed that the degree of heat used is sufficiently great to actually destroy the bacteria present in the tube. On the contrary it is by its stimulation that a phagocytosis is set up and the microphages, assisted by the opsonins of the blood plasma, become the avengers of the outraged tissues.

Another method of stimulation of undoubted value is that of mechanical vibration of the superior cervical ganglion whose ascending branch gives off an external branch to form the carotid plexus. A branch of this plexus joins a branch of the tympanic which supplies the mucous membrane of the tympanum and the Eustachian tube. To vibrate this ganglion pressure should be ap-

plied at the upper part of the anterior border of the sterno-cleido-mastoid muscle. Indirectly the superior cervical may be stimulated through the spinal connection at the upper cervical and also through the middle or inferior ganglion by vibrating lower in the neck.

As to internal medication camphor, aconite, belladonna and quinine have some therapeutic merit; but better results may be obtained by the administration of minute repeated doses of gelsemium. In the initial stage the greatest benefit to be derived from treatment, aside from overcoming the deafness and subjective noises, will be obtained, however, not from dosing a symptom, but from a proper understanding of the underlying causes which have made these symptoms possible. Therein lies the crux of the whole matter and therefore our energies should be directed towards the elimination of pathogenic products and the restoration of normal resistance. Recognizing the fact that the special activity of the bacteria immediately responsible for the present state of affairs has not been brought about without adequate cause, it becomes necessary to institute a thorough search for those systemic conditions producing the lowered vitality responsible for the present bacteriacidal victory.

It is to be assumed that the treatment of obstructions of the nose and naso-pharynx, of lesions resulting from traumatism of the tube itself through douching, instrumentation, or the introduction of foreign bodies, together with the prophylaxis to be observed in the exanthemata, need not be here particularized since such treatment scarcely comes within the scope of this paper. Neither is it pertinent to refer to the treatment of the conditions obtaining as a result of lues, cancer, or sepsis. We will usually find, however, that the goal of our therapeutic effort lies in the correction of an auto-intoxication resulting from a faulty metabolism and defective elimination by the skin, kidneys and bowels. Prompt flushing of these sewers miraculously terminates the progress of a great many diseases and none more quickly than the one under consideration. When possible, it is advisable for the first few days to treat the patient at his home where special diet, equal temperature and toilet necessities are assured. During this time other functional disturbances may be detected and prescribed for and the patient instructed in dietetics, exercise and personal hygiene according to his requirements.

## HOW MUCH ATTENTION SHOULD WE GIVE THE MIDDLE TURBINATE BODY IN DISEASES OF THE ACCESSORY SINUSES?

BY CHARLES M. ROBERTSON, M.D., CHICAGO, ILL.

In describing the anatomy of the nose mention is made of the scroll shape of the inferior turbinate body. It hangs well in from the external wall of the nasal cavity. This is not so of the middle turbinate. Its surface is markedly less scroll-shaped and the distance from its external surface and the outer nasal wall is very limited, being seldom more than four m. m. and often not over one or two m. m. Should there be a deviation of the septum with a hypertrophy of the turbinate or of the septum, it is wedged into the space so as to make it impossible to pass a pledget of cotton on either side of it.

The different types of middle turbinates are so varied that it is impractical to formulate much of a table of sizes and shapes. The extension of ethmoidal cells into this body makes its appearance varied and in most instances the two middle turbinates are asymmetric. We often find a long flat bone on the one side, while on the other we have a large mass composed of one or more ethmoidal cells. These cells may communicate with the cells above or may be distinct from them. We often find this body containing cysts which probably were or are cases of empyema of long standing in the body itself.

In cases where we have to deal with hypertrophic rhinitis we are impressed by the constant rule which hypertrophy follows.

We notice the first place to hypertrophy is the posterior end of the inferior turbinate body. Then the lower edge of the same body, after which comes the anterior end of the middle turbinate. This rule is almost constant.

In hypertrophy of the inferior turbinate, we have no serious conditions arising save the damming back of tears by the pressure on the lachrymal canal where it empties into the nostril and the occlusion of the nostril due to an overgrowth existing in the inferior meatus.

This is not so with hypertrophy of the middle turbinate and especially where the anterior end is mostly involved. The openings

of the anterior group of sinuses are thus pressed upon by the enlarged turbinate and as a consequence there is a closing of these cells from the air in the nose. I have studied this condition for some years past and become more and more impressed with the idea that pressure has to a very large degree to do with prolonging if not producing sinusitis.

In an article published a year or two since which appeared in the Journal of the American Medical Association, I called attention to a few cases of non-suppurative inflammation of these air cells caused by an enlarged anterior end of the middle turbinated body. These cases gave all the subjective symptoms of sinus disease but none of the objective ones. In all the cases, the middle turbinate was directly responsible for the symptoms present by occluding the orifice of the sinus by a swollen or hypertrophied condition. The truth of this statement was proven by reducing the size of the turbinate at which time the symptoms promptly disappeared.

We know in nearly all cases where an empyema of the antrum exists we have exuberant granulations about the orifice of the cavity and often associated with myxomatous degeneration of the anterior end of the middle turbinated body. This most books mention as a cause of empyema, but it is fully understood to be a sequence of sinus disease. I cannot recall many cases where I have had to deal with empyema of these cavities where the middle turbinate has been normal. Very little stress is paid these cases as far as the pressure closing is concerned, and I have repeatedly observed cases where an external or radical operation had been performed without first trying to establish communication through the natural orifice by amputating the parts encroaching upon the patency of the cavity involved.

This is the excuse I have for bringing this subject to your notice. I have gone so far as to tell students to expect sinus disease when polypi are found in this region and I now think it may be said the same holds true where the middle turbinate is hypertrophied so as to make the openings liable to pressure closure.

If when we examine a nostril we find a middle turbinate wedged in between the septum and the hiatus semi-lunaris we should see that it is removed. If we find the tissue of the anterior end of the middle turbinate myxomatous we should make an exploratory puncture of the antrum to see if there is not pus present. It will be surprising to find the large number of cases where the exploratory findings will justify our trial.

I should be pleased to have the expression of this body as to whether they think a sinusitis exists without hypertrophy of the middle turbinated body? I have seen some cases of long standing where there was room enough under the turbinate for drainage; but these cases were with a probable tubercular finding.

There are hypertrophies which may be very small and yet produce marked interference with ventilation and drainage of the sinus emptying into the hiatus semi-lunaris; whereas on the other hand a very large hypertrophy may leave sufficient room under it for both ventilation and drainage. The rule adopted by the author is to be guided by the space under the body rather than by the size of the body. If the turbinate is found to be encroaching on the side wall of the nose I invariably cut away the anterior end.

I am not advocating indiscriminate cutting of turbinates; for this is certainly a bad practice, as we know the chief function of the nose is destroyed by cutting away too much of the corpora cavernosa, and as a result atrophic changes occur in the nose and pharynx. We should aim to remove enough tissue to produce space sufficient for the escape of all secretions and give a chance for drainage. Any more than this is to be decried. Many specialists are prone to be too free in the use of the knife and thereby sacrifice more tissue than is necessary. A turbinate which is hypertrophied cannot perform its normal function, as we all recognize; yet it is a vicious habit to destroy any more tissue than is absolutely necessary.

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## THE OTO-PROJECTOSCOPE.

BY M. A. GOLDSTEIN, M. D., St. Louis.

Some five years ago, it occurred to me that if the principle of the simple otoscope could be so elaborated and mechanically perfected as to project the picture of the membrana tympani and the fundus of the external auditory canal, on the screen, as effectively as the simple otoscope presents such a picture to the retina of the eye, it would be of inestimable practical value for clinical demonstrations, and for permanently recording and describing the morphology of this field in otology.

In proceeding with my investigations along these lines, the first serious obstacle met with was the question of the source and intensity of light. In this connection, it may be of interest to briefly record the development of the otoscope. The main principle in the construction of every form of otoscope is a light-reflecting surface placed at an angle to throw gathered rays of light parallel to the axis of the auditory canal, and cause these rays to be reflected through a central aperture in the mirror to the eye of the observer at the proximal end of the otoscopic tube.

In the simple Brunton otoscope, the light is gathered in a metal cone at a right angle to such a tube and placed directly over a flat mirror, the reflecting surface of which is toward the ear and fixed at an angle of 45 degrees. The source of light in such a simple apparatus is daylight or, at best, a bright beam of sunlight.

Another development in the construction of the otoscope was presented by Weber-Liel in combining the principle of the Brunton otoscope with that of the microscope. In this the simple lens at the proximal end of the otoscopic tube was replaced by a microscopic eye-piece of proper focal distance, so that a decidedly magnified image of the membrana tympani and the fundus of the ear could be obtained.

A new feature was offered by Myles, who inserted a small low-candlepower electric lamp and reflector in place of the open, funnel-shaped, light-collecting section of the otoscopic tube.

In my first experiments to develop a projected image, I soon realized that neither focussed sunlight nor any form of incandescent

electric bulb offered sufficient light to reflect a bright image on the screen. I was therefore convinced early in this research that a more intense and bulky light resource was required and consequently portability could not be included as one of the features of such an apparatus.

The problem to be developed, then, was that of combining the otoscope with some form of projection apparatus in which the arc lamp with its high candle-power and concentrated form of light could be used. A 2,000-candle-power right-angle, hand-feed arc-lamp was finally selected as the most satisfactory source of light of sufficient intensity available for this work, and it was also found to be the only light capable of being properly focussed and concen-

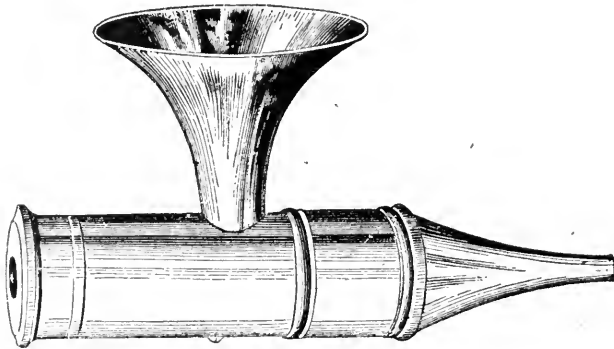


Fig. 1. Brunton's Otoscope.

trated into a beam small enough to pass through the central aperture of the reflecting mirror to the fundus of the auditory canal.

The elimination of the intense heat generated by concentrating so powerful a beam of light into the auditory canal, one which was unbearable to the ear of the patient, confronted us. This was overcome by interposing an alum tank of sufficient capacity between the lenses of the projection apparatus and the otoscope. By means of this accessory, the powerful beam of light which reaches the ear can now be projected for a prolonged sitting without any discomfort whatever to the patient.

Perhaps the most difficult optical feature to be considered was the establishment of the proper adjustment and focal distances of the

lenses used in obtaining our projected image. The first of the series of lenses are those of the projection apparatus, and consist of a combined plano-convex system of five-inch diameter lenses, (c) placed between the arc-lamp and the alum tank (g). This lens system (c) is located in the large end or base (B) of the elongated cone (h) of the otoscope. By means of these lenses the light of the arc-lamp is concentrated and parallelized on the polished plate-glass mirror (j) and projected through the tube (i) and the adjustable ear speculum (k) to the fundus of the canal and tympanum. The central aperture in the mirror (j) admits of passage of the reflected rays from the tympanum to the projection lenses (l), and from this point the image (x) is thrown on the screen (D). The

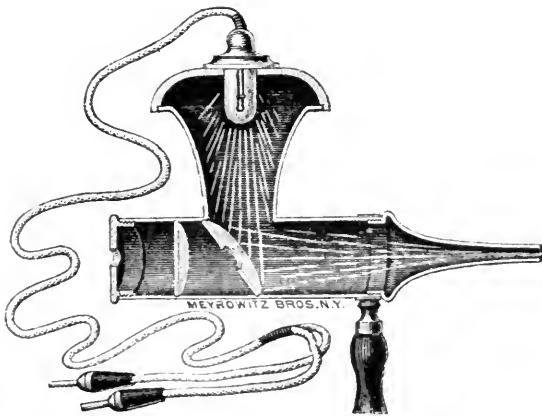


Fig. 2. Myles' Electric Otoscope.

lenses (l) are of the photographic projection system of from four to six inches focus, and admit of a considerable adjustment of the image by means of rack and pinion (m). The ear specula (k), are of different sizes, each of which may be readily substituted and fixed into position in the cylinder (i). The right-angled piece of the otoscope (C) containing mirror and projection lenses can be swung to either right or left side of the apparatus and securely fixed by milled screws (n). All of the metal parts of the otoscope are made of spun brass of 1-16 inch thickness, the interior of all tubular parts are carefully blackened, and each section of the apparatus can be taken apart for cleaning and readjustment.

The projection cabinet (A) is made of carefully seasoned quarter-sawed oak, and the entire interior of this cabinet is thoroughly lined with sheet asbestos. The arc-lamp is secured to an adjustable and movable platform so that it may be focused the full range of the length of the projection cabinet. The dimensions of this cabinet are 18 inches long, 10 inches wide, and 14 inches high. Thorough ventilation and outlet for the heat generated by the electric lamp is secured by the circular openings (b) around the base of the cabinet, and by the asbestos chimney (e). The cover of the cabinet (d) is of asbestos board. A small door (f) is hinged in one side of the cabinet, fitted with a ruby-glass window to observe the proper adjustment of the carbons of the arc-lamp.

In the accompanying illustrations, the relative positions of the projection cabinet (A), the otoscope attachments (B and C), the screen (D), and the patient (E), will be seen.

To add to the practical value of this apparatus, an epidiascope of simplified form (F) has been constructed, which may be readily attached to the projection apparatus (A) by removing the otoscopic attachment (B and C). With this accessory and an additional series of projection lenses (o), any picture or object in black-and-white or in colors, instruments, pathological specimens, bone specimens, or in fact any object required for demonstrations, may be thrown on the screen in original color and contour. The results obtained by this simple form of epidiascope are equally as effective and the projections of as equally good a definition as those obtainable by even the most expensive and complicated form of projection apparatus. Objects to the size of a median section of the human head may be thus projected. In a recent demonstration I was enabled to show the technique of passing the Eustachian catheter on such a head-section to my entire class of over one hundred students.

A word or two as to the practical value of this apparatus. Those of us who are teachers in otology realize how difficult it is to demonstrate the fundus of the auditory canal, the membrana tympani, or the tympanic cavity in their pathological variations. These areas are visible to only one observer at a time by the usual methods of examination by aid of speculum and reflected light. Even when the attention of a group of students is called to pathological points and lesions in these localities and they examine the patient, one after the other, the teacher is unable to determine whether the features which he is endeavoring to point out have been appreciated by the student observers.

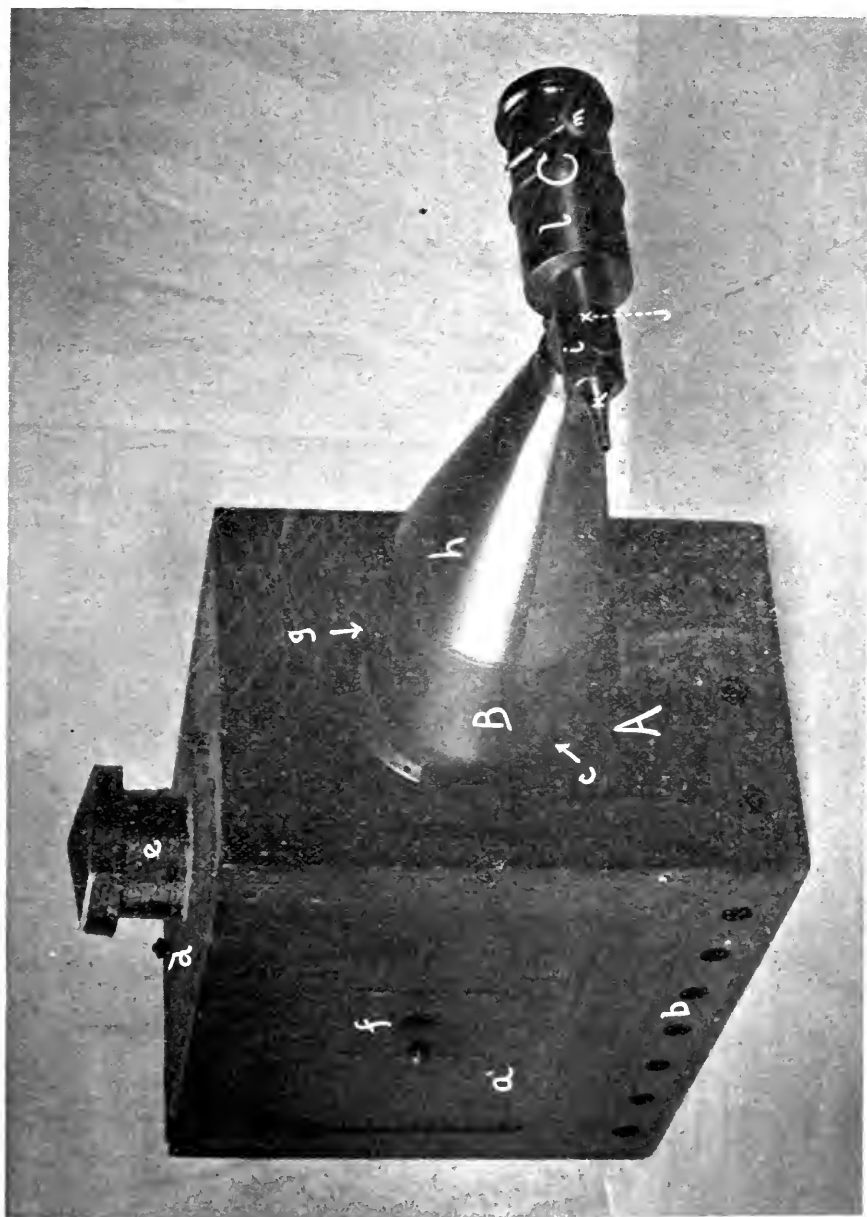


Fig. 3. Projection Cabinet A with Oscope B-C;  
b, Perforated base for ventilation. c, Lens system in B; d, Asbestos cover. e, Asbestos chimney. f, Door with ruby glass window.  
g, Alum tank in B. h, Cone, connecting B and C.

The oto-projectoscope overcomes this difficulty by throwing a picture of the fundus of the canal, the membrana tympani, or the cavum tympanum on the screen, where its details may be elaborated by the demonstrator and the entire group of students may see the image simultaneously. The picture is unusually bright and shows every line of the illuminated areas distinctly. The small radiating blood-vessels, the natural lustre of the membrana tympani, the triangular light-spot, pus, perforations in the membrana tympani, pulsation of fluid within the tympanic cavity, granulations, polypi, and other equally important pathological features have been clearly demonstrated with this apparatus.

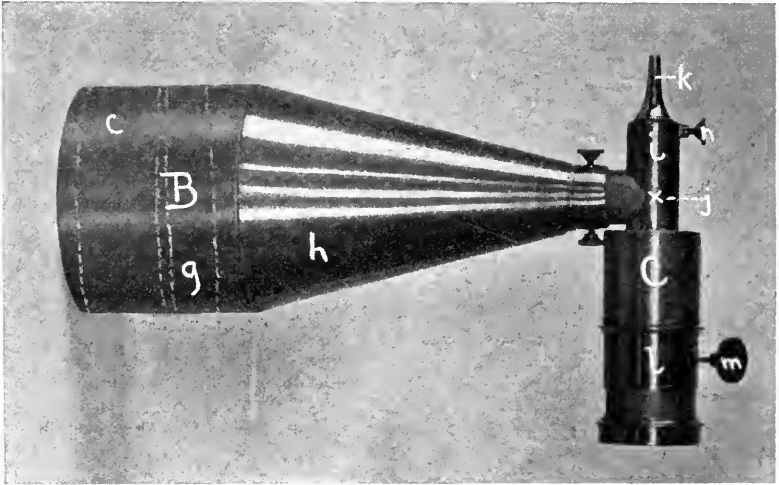


Fig. 4. Author's Ootoscope.

c, Lens system. g, Alum tank. h, cone. i, Speculum cylinder. j, Reflecting mirror. k, Ear speculum. l, Projection lens system. m, Focusing screw. n, Screw to fix speculum.

The image thrown on the small, adjustable white paste-board screen is about four c. m. in diameter at its most brilliant focal point, about three feet from the projection lens.

Not only is the Oto-projectoscope available for demonstrations in otology, but the nasal and pharyngeal cavities may also be included in this consideration. It is simply necessary to substitute a nasal speculum or mouth piece for the ear speculum in the tube (i) and change the adjustment of the projection lenses (l) in order to obtain most satisfactory views of the nares and pharyngeal cavities.

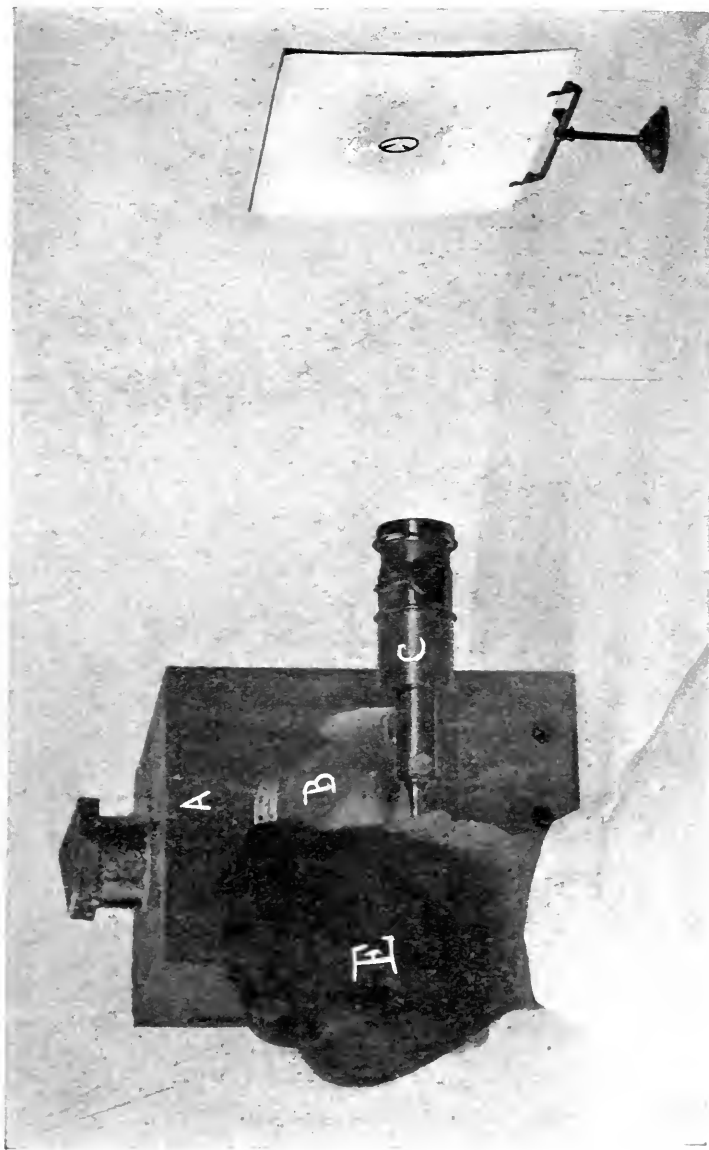


Fig. 5. Oto Projectoscope C' complete.  
 A, Projection cabinet and are light. B, Metal cylinder and cone containing lens system and alum tank. C, Oscope attachment with projection lenses and ear speculum. D, Flat, white card-board screen, mounted on movable and adjustable iron stand.  
 E, Position of patient, with otoscope adjusted in auditory canal.

Until now, no successful photographic reproductions of clinical pictures of these areas have been obtained. I have already succeeded in photographing the pictures thrown on the screen and am perfecting and elaborating this feature in a forthcoming paper. I hope to be able to prove that this will be an invaluable means of securing permanent records in photographic form of the pathology of the middle ear and membrana tympani.

In the past year there has been considerable agitation along the lines of photo-therapy. Some of our French colleagues have recently reported the satisfactory treatment of tinnitus aurium by means of light-therapy. If there is a future for this form of therapeutics in

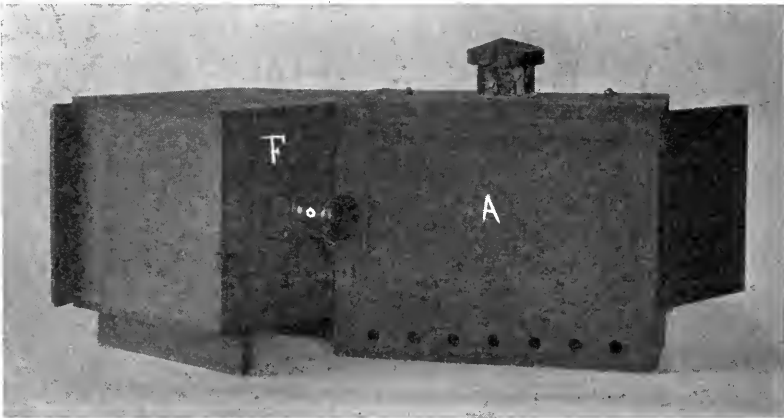


Fig. 6. Epidiascope.

F, Epidiascope cabinet. A, Projection cabinet. o, Epidiascope projection lenses.

the treatment of ear diseases or symptoms, it may be most effectively accomplished by the oto-projectoscope, because there is no other source of light so intense as that generated in this apparatus, and no other appliance by means of which so intense a light, properly cooled, can be made to penetrate the tympanic cavity.

Trans-illumination has been the subject of much investigation and discussion as an aid to diagnosis of the anomalies and pathology of the accessory sinuses, and there have been many electric devices suggested to aid us in these observations. I have constructed a small mouth tube which may be substituted for the ear speculum, and by means of which the most intense and satisfactory trans-illumination of the sinuses may be obtained. It is especially to be empha-



sized that the light from the Oto-projectoscope is cool, and offers this additional advantage over any other form of electric light used for trans-illumination.

The simple epidiascope attachment adds another resource to the teacher in otology. By its means, all specimens, normal and pathological, large and small, osteological and soft parts, drawings, charts, text book illustrations, and every other available objective and tangible resource of the teacher can be utilized for class instruction. It is a pleasure to see how sharply defined the outlines of an osteological preparation of the temporal bone with its ossicles, semi-circular canals, and cochlea can be projected on the screen and viewed by an entire class at a distance of twenty feet.

In conclusion, I wish to express my deep obligation to Rev. Henry J. De Laak, S. J., professor of physics at St. Louis University, for his most valuable co-operation in conducting the numerous trials and experiments necessary to perfect this apparatus. I am especially indebted to him for the epidiascope idea in its simplified form and for the privileges accorded me in his laboratory for developing this apparatus.

My thanks are also due to Mr. William A. Phillips, electrician, Ozark Bldg., St. Louis, for mechanically perfecting and constructing this apparatus.

Mr. Phillips is authorized to construct duplicates of the Oto-projectoscope model described in this paper.

In a future paper I expect to produce more data and practical evidence of the possibilities of the Oto-projectoscope.

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## THE DISEASED FAUCIAL TONSIL AND ITS OPERATIVE TREATMENT.

BY WILLIAM R. MURRAY, PH. B., M.D., MINNEAPOLIS, MINN.

The operative treatment of the faucial tonsil is a subject on which a great deal has been written during recent years, and certainly great advances have been made not only toward a better appreciation of the many complications that may arise as a result of the presence of a diseased faucial tonsil, but especially in the operative treatment of the same.

Whatever the function may be of normal tonsillar tissue, and it is still a disputed question, when the gland becomes hypertrophied and the seat of a chronic inflammation, it not only ceases to exist as a functioning organ and to serve any useful purpose in the economy of the body, but, in its diseased condition, with the crypts and cavities filled with decomposing material, and constantly exposed to the presence of pathogenic organisms, it becomes an incubator for the propagation of these microbes, and for the dissemination of their toxins to other portions of the body.

In considering the indications for the extirpation of the diseased tonsil it is only necessary to remind you of the results which may follow the presence of such a diseased gland, and these may be roughly classed as follows:

1. Mechanical obstruction.
2. Recurring attacks of acute or sub-acute inflammation.
3. Extension of the inflammatory process to adjoining structures, thereby causing an acute or chronic congested condition of the same.
4. Acting as receptacles for foreign matter and pathogenic germs which find lodgment in the crypts and cavities of the diseased tissue.
5. The dissemination of these germs by means of the lymphatics or blood vessels and the infection of neighboring or distant organs of the body.

That form of tonsillar hypertrophy which is sufficiently great to cause a mechanical obstruction in the fauces or which is subject to recurrent attacks of acute or sub-acute inflammation, with its attendant train of symptoms, is generally promptly recognized by the profession as operative and its removal advised, but in that form of diseased tonsil termed the submerged tonsil, where the complications that may arise are equally serious and equally numerous, the indica-

tion for their thorough removal is sometimes overlooked, especially in those cases where there are no acute symptoms referred directly to the tonsils. It is a matter of common observation to find remnants of a diseased gland, remaining after a former tonsillotomy, giving rise to serious trouble, and many cases of submerged diseased tonsils are the remaining portions of hypertrophied glands which at some former time have been partially removed.

It is not my purpose to present to you a detailed review of the numerous investigations which have been carried out and the many clinical cases cited, which have established the great importance which this diseased gland may have as an etiological factor in both local and general infections. In addition to its influence as a causative factor in diseases of the upper respiratory tract and the many reflex disturbances which it may give rise to, there has been an abundance of clinical evidence published showing the diseased faucial tonsil to be the source of infection in such serious complications as tubercular cervical adenitis, septicaemia, pneumonia, gastritis, septic endocarditis, acute articular rheumatism, et cetera.

I would call your attention to the fact that the actual size of the tonsil is but a minor factor in the indications for its removal; that an old tonsillar stump remaining after a former tonsillotomy, is, if subject to inflammation, capable of giving rise to most annoying and often serious complications; that a submerged tonsil is capable of causing as much trouble as a gland that is enlarged to such an extent that it may cause some mechanical obstruction; that the faucial tonsil is situated at the gate-way to the lymphatic chain; that in a case of chronic inflammation of the gland the diseased tissue is likely to extend to the bottom of the gland, and that it is from the deeper portion that the infection is most likely to be carried into the lymph stream and circulation, and when we consider these facts, it would seem that the indication would be clear to remove the entire gland in order not only to relieve the present trouble, but to prevent any recurrence.

In considering the operative methods of removing the faucial tonsil I desire to mention only those procedures which fulfill the indications present in all cases of a diseased tonsil—namely the extirpation of the gland. Personally the use of the guillotine has become with me an obsolete method of operating, removing, as it does, but a portion of the diseased tissue, it leaves the remainder of the gland to give rise at some future time to further trouble, and is

a procedure which has proven, in my experience, to be extremely unsatisfactory.

The particular method to be employed in the extirpation of the gland will depend upon each individual operator, and will also be governed by the indications present in each individual case, but our aim should be to remove the gland by the simplest, quickest and most satisfactory method and the one which is attended by the least danger and inconvenience to the patient.

A method which I formerly advocated for the removal of that form of diseased tonsil termed the submerged tonsil, is the use of the Robertson' tonsil scissors, and while excellent results may be obtained by the use of these instruments I believe that, in the great majority of cases of all forms of hypertrophy, the entire gland can be removed by other methods more quickly, easily and safely and with less inconvenience to the patient.

The method of removing the gland by cautery dissection, is an operative procedure with which I am not sufficiently familiar to warrant my drawing any positive conclusions, but it has always seemed to me that the time required, to thoroughly accomplish the end to be attained, is unnecessarily long, and that in the separating of the eschars, resulting from the extensive cautery work, it might subject the patient to the dangers of hemorrhage and infection. However, I have no doubt that in the hands of Pyncheon who has had so much experience in this method of operating, the results are satisfactory.

In mentioning the use of the snare, scissors, knife and traction forceps, a method which I almost universally employ, it is unnecessary for me to go into the details of the operation, and I desire to mention only those steps, the proper performance of which makes the operation simple and thorough, while a failure to observe them will often be followed by unsatisfactory results.

While this method of operating is usually spoken of as tonsillectomy by means of the cold wire snare, the use of this instrument is, especially in the case of embedded tonsils, the least important step of the operation, as the complete removal of the tonsil by means of the snare will depend upon the thoroughness and manner in which all attachments of the gland, to surrounding structures, have been separated before the snare is applied. After drawing the gland forcibly toward the median line by means of the traction forceps, the anterior pillar can be separated by means of the blunt pointed right

angled tonsil knife or the right angled tonsil scissors. I prefer the former as the blade can usually be easily passed well down to the base of the gland and thorough separation made upwards and downwards with less danger of wounding the pillars and causing hemorrhage. After separating the posterior pillar in a similar manner, a point of importance is the thorough separation of the upper portion of the gland at the apex of the tonsillar fossa, and for this purpose I make use of a scissors curved on the flat, and so thoroughly divide all attachments in the supra tonsillar space that the upper part of the gland can be readily turned downwards by traction with the forceps. The bottom of the gland can then be separated in a similar manner by means of the tonsil scissors. After the gland has been encircled with the loop of the snare, the blades of the traction forceps should be separated widely enough to grasp firmly both the upper and lower portions of the tonsil, so that when traction is made both the upper and lower portions of the gland will be drawn well out of the fossa, allowing the wire to slip easily down around the remaining part of the tonsil when it can be readily drawn through and the gland removed.

I usually use a No. 7 piano wire, and without the use of the grooved ring which frequently accompanies a tonsil snare. Such a wire possessing sufficient resiliency to enable one to force it thoroughly down around the base of the gland.

When operating under general anaesthesia, if the operator has difficulty in using the knife or scissors in the left hand, it will be found convenient in removing the left tonsil to stand at the patient's left side in order that he may have the knife, scissors and snare in his right hand, and in removing the right gland to be seated at the head of the table, and thus have the free use of the right hand for the same instruments.

The reaction following this method of operating is somewhat greater than that following the use of the guillotine, the amount of reaction and discomfort varying considerably in different individuals, and is considerably greater in adults than in children.

In regard to the after treatment it is of great importance that the throat should be kept cleansed as thoroughly as possible, by means of sprays, gargles and mouth wash, during the healing process, and that the patient should be kept under observation and treatment for a sufficient period of time to insure thorough and complete healing of the wound. If this is not done the patient will be subjected to the dangers of a secondary hemorrhage. I have had two such cases

occur ten days after the operation, from the erosion of a small blood vessel, and while the bleeding was not alarming, it was very annoying and somewhat terrifying to the patient and family.

Another point of importance in regard to the after treatment, more especially in the case of children, where the operation includes the removal of adenoids, is the advisability of prescribing some form of an iron tonic, as there is a considerable loss of blood accompanying an adenectomy, and moreover, many of these little patients are already anaemic and poorly nourished as a result of the impaired oxygenation of the blood due to defective breathing. I have, in a number of cases, had a blood count made immediately before operating, a second count taken a few hours after the operation, and a third one after a period of four or six weeks, and a comparison of such counts will show a decrease of reds and a leucocytosis on the second count, followed by a rapid increase of reds during the following few weeks.

The choice of an anaesthetic in these cases is a subject of great importance. In the extirpation of a faucial tonsil in an adult, I generally employ local anaesthesia, making thorough applications of a ten per cent. solution of cocain and a 1 to 1000 solution of adrenalin, and I usually precede the use of the cocain by the administration of gr. 1/20 of strychn. sulph.

In the case of children, where it is necessary or advisable to use general anaesthesia, our first consideration should be for the welfare of the patient, and that form of anaesthesia should be chosen, which experience has proven to be the safest, provided it meets the requirements of the case, and it should always be born in mind that there is an already existing interference with respiration from the presence of an hypertrophied pharyngeal or faucial tonsil with its encroachment upon the lumen of the air passages.

The use of the more transient anaesthetics such as nitrous oxide and ethyl bromide produce an anaesthesia of too short a duration to be satisfactory in this method of operating, and our choice will be limited to the use of chloroform or ether or both.

In the absence of contra indications such as bronchitis, nephritis, etc., and with the proper care of the patient and avoidance of exposure, after the operation, I believe it is the consensus of opinion among operators that the margin of safety is considerably greater in the administration of ether than in the use of chloroform, and this is especially true in this class of cases, where there is an interference with respiration from the presence of a naso-pharyngeal obstruction.

A second point, in favor of ether, is the possibility of obtaining a longer period of anaesthesia, if the anaesthetic has been pushed to deep narcosis, a point of considerable importance in operations on the upper air passages, where the anaesthetist and the surgeon occupy the same field of operation, and the former is compelled to suspend the administration of his anaesthetic in order not to interfere with the work of the latter.

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## THE CLINICAL SIGNIFICANCE OF OTALGIA.

BY PERCY FRIDENBERG, M.D., NEW YORK.

Elevation of body temperature, local signs of inflammation, and pain, more or less severe, are the cardinal symptoms of acute otitic disease. Of these, ear-ache, while frequently the immediate determining cause in the invocation of medical aid, and perhaps the most striking and significant aural symptom, is also the most variable, difficult of interpretation and misleading. This is due to a number of factors. The subjective character of pain, renders it difficult of registration and measurement and hence of record and comparative study, besides introducing the element of individual susceptibility as a personal equation of the patient into our calculation. Aggravation, on the one hand, dissimulation, through fear of operation on the other, are the Scylla and Charybdis between which the surgeon must steer his diagnostic bark. A morbid change in the personality of the patient incidental to stupor or phlegmatic mentality in the adult, or to high fever, delirium or fright in children, still further complicates our task, so that actual pain may be overlooked, or, again, be erroneously inferred when absent or negligible.

It is not this element to which I desire to call your attention, as similar factors of personality and judgment, of individualization, enter into many questions of diagnosis and are the test of the common sense and perspicacity of the surgeon rather than of his technical skill and special knowledge. The factors which are to form the basis of my remarks on otalgia and its significance in diagnosis are of an anatomical and clinical (physiological) rather than of a psychical nature, and at the outset of our study two important facts present themselves.

First, that aural pain has a markedly varying significance, according as it is autogenous, direct, or transmitted, reflex. And here, as in the factor just cited, we have a double significance, and a two-fold application. Pain at a distance may indicate aural disease, and aural pain may be a symptom of disease in distant organs. A brief recapitulation of the innervation of the organ of hearing and of the reflex arcs connected with it, may be in order. The external aspect of the concha, the anterior and superior canal wall,



and the outer surface of the drum-membrane are supplied by the auriculo-temporal nerve, a branch of the third (inferior maxillary) division of the trigeminus. The convex surface of the concha and the integument of the mastoid are innervated by the auricularis magnus from the superficial cervical plexus; the posterior canal wall (and, according to Gray, the integument at the back part of the pinna) by the auricular branch (Arnold's) of the pneumogastric which anastomoses with the facial directly and with the posterior auricular branch of the same nerve. The sensory nerves of the middle ear and Eustachian tube are filaments from the tympanic plexus formed of the tympanic branch (Jacobson's nerve) from the petrous ganglion of the glosso-pharyngeal, the small petrosal from the otic ganglion of the trigeminus, and several branches from the carotid plexus of the sympathetic.

This complex innervation supplies the possibility of irradiation of pain to, and reflex irritation from anastomosing branches of the vagus, sympathetic, trigeminus<sup>1</sup>, glosso-pharyngeal and superior cervical sympathetic plexus. Thus the auricularis magnus also supplies the parotid and the integument over the occipito-frontalis muscle: the auriculo-temporal, by its branches to the facial, supplies the articulation of the jaw: the posterior auricular terminates in the integument of the occipito-temporal region: the spreading of ear-pain to the temples, vertex, occiput jaw, teeth, and shoulder is thus explained. More distant structures are also connected. The principal regions thus concerned are the commencement of the digestive tract, buccal cavity and pharynx, supplied by the second and third division of the trigeminus.

The teeth are frequently the point of origin of reflex ear pain either by reason of carious roots, periostitis or other inflammatory processes, or by mechanical irritation such as that coincident with difficult dentition or the irruption of a wisdom tooth<sup>2</sup>. Small ulcerations of the hard palate, mucous membrane lining the cheek or the tongue, may cause similar reflexes and in the case of carcinoma of the tongue, otalgia has been observed as one of the earliest symptoms. Aural disturbances may be reflected from the nasal cavities. Makuen (*LARYNGOSCOPE*, July, 1904), reports having a somewhat painful proof of this fact some years ago in his own

1. Tumors of the brain or Gasserian ganglion, disease in any part of the fifth nerve, a trigeminal neuralgia, may all occasion ear-ache.

2. While the reflex dental origin of the ear-ache is usually recognized promptly by a negative finding in the ear, it may be obscured in very young children and infants by the mechanical difficulties attending a satisfactory and conclusive otoscope examination. This difficulty is not fully appreciated, even by the profession. The skillful, patient and persistent employment of every technical resource, and even the administration of a general anaesthetic, may be rendered futile by the extremely small field or by the formation of a necrotic layer upon the drum, or the accumulation of debris over it.

person. A unilateral intranasal pressure caused, among other things, distressing sensations in the ear of the affected side, occasionally attended by dizziness, all of which symptoms were promptly and permanently corrected by the removal of a septal spur. Several similar cases occurring in this author's practice have convinced him that vertigo should be included among the possible nasal neuroses.

In chronic abscess of the tongue, which may simulate dermoid or simple cyst, there may be intense ear-ache persisting in spite of narcotics, and giving rise to extreme suffering and anxiety on the part of the patient, and to grave concern on the part of the physician. There may be absolutely no spontaneous or superficial tenderness in the part of the tongue affected. Richardson (J. Am. Med. Ass'n, Feb. 26, 1898), reports a most interesting observation of this kind in a young girl of eighteen. There was intense and persistent ear-ache, unrelieved by  $\frac{1}{4}$  gr. of morphine by hypodermic, suggesting the presence of acute otitis, but repeated aural examinations failed to reveal any abnormality of the canal or drum, and hearing was unaffected. While examining the patient's pharynx, the happy idea occurred to Richardson that the mass at the base of the tongue might be the cause of all the trouble, although appearing perfectly benign. (This mass had been present since early childhood, and had never caused any inconvenience). On compressing the growth the patient gave evidence of most intense pain. Incision, curettage and packing of the abscess cavity brought immediate relief of the symptoms. There was no change of the tissues over or about the seat of the abscess. It was only when firm and great pressure was exerted that any evidence of pain was demonstrated.

The ear-ache of tonsillitis, of diphtheritic angina and that following intra-nasal operations and removal of adenoid hypertrophies, are well-known and require but passing mention. That tubercular or syphilitic ulceration of the naso-pharynx may cause similar symptoms is not so well known and acquires practical importance from the fact that these lesions may easily be overlooked in direct inspection of the pharynx and are to be discovered only by posterior rhinoscopy. Conversely, pain in the throat and obstinate cough, may appear as reflex manifestations of aural irritation, slight in itself, particularly that of the drum or external canal, such as is caused by the presence of foreign bodies, impacted cerumen, applications, the contact of a probe with the tympanic membrane or

even the introduction of a cold speculum.<sup>3</sup> The entrance to the larynx, epiglottis and arytenoids, supplied by the superior laryngeal from the vagus, are also affected by this reflex, as well as being concerned in attacks of otalgia, when ulcerated, (*e. g.* in tuberculosis). The parotid and the temporo-maxillary articulation finally may be affected (as in mumps or monarticular rheumatism) and give symptoms which are referred to the ear.

The localization of true aural pain is itself very inexact at least as concerns all but the most superficial regions. While the patients' statements may be precise as to pain over the mastoid area, the pinna, or the canal wall, the description is very vague in regard to the drum, tympanic cavity, Eustachian tube and pneumatic spaces, and is generally summed up in the complaint of pain deep down in the ear or inside the head. The character of the pain is but little more conclusive, for while throbbing, beating pain of a continuous character speaks for an inflammatory process, and lancinating pains with free intervals for neuralgic affection or reflex irritation, these inferences are to be drawn with great caution and not always to be relied upon. While the results of careful inspection and clinical examination in its widest and fullest sense are always to have the first consideration, there are undoubtedly peculiarities in the subjective symptoms which may prove valuable diagnostic aids. In inflammatory affections of the external canal, particularly in those of a circumscribed character, pain is a constant symptom. In furuncle it is generally acute, can be fairly accurately located, and is limited to a small area which can be most easily determined by delicate probing with a cotton wound applicator. It is more frequently, if less artistically, discovered by the intense pain that is caused on the introduction of an ear speculum. It is increased by manipulation of the pinna, especially by traction on the posterior wall, less frequently by pressure on the tragus, or spontaneously in moving the jaw or chewing, and not at all by sneezing, coughing or blowing the nose. It is generally relieved

3. The irritation of a foreign body or of impacted cerumen may cause not only severe radiating pain and intense headache of a hemicranial character, but nervous reflexes as well, such as obstinate salivation (Power), spasmodic cough, chorea, epileptic and eclamptic convulsions, loss of consciousness, meningeal irritation, vomiting, decreased pulse rate and psychical disturbances, amnesia, confusion of ideas; and Kirkendall (Section on Ophthalmology, Am. Med. Assn., July 1905) reports a case of obstinate muscular asthenopia with insufficiency of convergence due to this cause, which had been under the care of several prominent oculists, and was promptly cured by the removal of a plug of wax from the ear. Vertigo, nausea and vomiting, as well as syncope and convulsion have not infrequently been observed after minor operations (paracentesis, curettage of middle-ear, incision of furuncle) and even after such comparatively innocent procedures as politzerization and syringing-out the ear.

In affections of the chorda tympani nerve, which not infrequently complicate acute or chronic middle-ear inflammation, reflex stabbing pain may be felt at the edge of the tongue, radiating from the middle to the tip.

promptly by incision. As hearing is not affected unless the inflammatory reaction be so intense as to occlude the lumen of the canal completely, the diagnosis is usually free from difficulty. There are exceptions, however, and in these cases some time may elapse before the picture becomes clearly developed. Thus, in the very earliest stage of a furuncle there may be diffuse pain without marked local swelling, and irradiation into the teeth, temple, neck, or occiput. A deep-seated furuncle of the posterior canal wall may cause periostitis with doughy swelling at the posterior attachment of the pinna sufficient to obliterate the sulcus between it and the mastoid region and so arouse suspicion of grave disease. Diminution of hearing due to impacted cerumen or to previous ear disease must also be borne in mind, as also, finally, the possibility of a complication of furunculosis by an actual otitis media or mastoiditis. Decision as to this point may be very perplexing when, as occasionally happens, the furuncle is caused by infection of hair follicles in the canal due to the discharge from a running ear.

Acute inflammation of the middle-ear whether serous or purulent is almost invariably attended with pain. At first this is apt to be intermittent and not severe, coming on at night,<sup>4</sup> lasting for an hour or two and disappearing spontaneously; or, after the application of heat or of some household remedy. It is generally deep-seated, boring or throbbing and diffuse, and may be accompanied by general headache. The free intervals tend to become shorter, and the pain is increased on lying down as well as on any increase of intra-tympanic pressure as in politzerization or catheterization in swallowing, coughing, blowing the nose; so that these acts are anxiously avoided and dreaded by the patients. Manipulation of the ear has no effect upon the pain, which is due to pressure on and tension of the inflamed drum. Its degree varies and is dependent on the amount and character of the fluid in the tympanic cavity, the resistance of the drum membrane, and perhaps on individual peculiarities. In children the pain is frequently of short duration, slight or absent. The retained fluid becomes purulent more quickly than in adults on account of the shorter and wider communication with the naso-pharynx, perforation takes place sooner and even before this, the drum, being thinner and laxer, yields more easily to pressure.

4. Most earaches occur at night. McAuliffe (Trans. Am. Otol. Soc. 1903) ascribes this to the dorsal decubitus in which tubal drainage and the circulatory balance of the ear are theoretically not as good as in the erect posture and advises for aural patients a semi-reclining attitude with the helix of the affected ear uppermost to give forward and downward drainage.

Aside from spontaneous complaints of the little sufferers the most generally observed manifestations of earache are twisting or tossing of the head, burrowing into the bedclothes, ear-tugging, boring the finger into the canal, pain on manipulation of the ear, disinclination to rest head on affected side. Not infrequently general restlessness, crying out in disturbed sleep, peevishness, refusal of nourishment, may be the only indications of suffering, and Halsted (*Jour. Med. Soc., S. N. Y., Jan. 30, 1900*), and, more recently, Kerley (*N. Y. Med. Jour., July 8, 1905*), have drawn attention to the fact that in a large percentage of cases of acute otitis media there was no pain at all.

The most interesting clinical feature in Kerley's study was the absence of pain or localized signs by manipulation in fifty of the cases, or sixty-nine per cent. Among the pain group are included those who were very restless, who slept poorly, those who evidenced any great discomfort. Upon discovering the ear disease and noting the relief which followed incision of the drum membrane, it was fair to assume that the source of discomfort rested in the ear. Had it been left for the usual signs of pain or tenderness of the parts, in fifty of the cases a diagnosis of otitis would not have been made when it was. Six were seen in consultation because of the unexplained, continued fever. Nine had been treated by other physicians. In none of these had ear involvement been suspected, because of the absence of pain and localized signs.

While juvenile otitis may exist without pain, pain rarely exists without otitis. The belief so common among the laity and, unfortunately, to some extent also in the profession, that earache in children is ordinarily neuralgic cannot be too energetically combatted. The frequent, evanescent aural pain of childhood is suggestive of Eustachian obstruction, due to adenoids with retention of catarrhal secretion in the tympanic cavity.

Pain recurring some time after the subsidence of acute symptoms of otitis media, especially when attended by sudden cessation of discharge, is generally a danger signal, indicating insufficient drainage or progressive involvement of bony structures. It is of even greater significance in chronic otitis which is generally painless until complications develop, such as mastoid suppuration or intra-cranial disease. Otitis running a subacute course from the start, with comparatively little pain, should arouse suspicion of tuberculosis.

With the extension of an inflammatory process to the mastoid antrum and cells, pain may be spontaneous or elicited only on

pressure. Leaving out of consideration the local signs of purulent bone involvement, such as the typical fundus changes, mastoid or cervical oedema, and the systemic symptoms, all of which combine to form a well-known picture, let us consider the character of the mastoid tenderness; and, first of all, certain sources of error in its determination and interpretation.

The pressure should be made with the ball of the thumb, carefully avoiding the use of the nail, while standing in front of the patient so as to observe the facial expression which is often more enlightening than any statement. At the same time pressure should be exerted on the opposite mastoid for comparison. It should be gradual at first, and the entire apophysis palpated from above the level of the pinna down to the very tip of the mastoid and still further if there appears to be any tenderness in the neck. Care must be taken to avoid pressing on the auricle or fibro-cartilage of the meatus. Three points should then have our particular attention. The region of the antrum directly back of the upper canal wall, the tip, and the region of the mastoid emissary vein, about 1 1/2 inches back of the lower border of the meatus. A shifting of the point of greatest tenderness from one of these localities to another is often of great significance. Superficial inflammation, such as dermatitis or a mild periostitis, may confuse us. A gland is often found on the mastoid plane which, even under normal conditions is tender, and when inflamed may be so exquisitely and persistently painful as to simulate mastoiditis (McKernon). This should be pushed to one side or avoided altogether in palpating, if we are not to be led astray. A leechbite or an infected hair follicle may in a similar manner prove a pitfall for the careless examiner.

The cardinal symptom of acute mastoiditis is the invariable local tenderness over the antrum which is situated directly back of the attachment of the concha at the level of the external meatus at a depth varying according to the greater or less development of the cortex. In chronic disease tenderness may be entirely absent.

Tenderness in front of and slightly above the ear is rare, and when due to otitis, is indicative of extension of a purulent process to the cells in the zygoma. Infra-auricular and lateral cervical pressure pain may be due to tonsillitis, inflamed cervical glands, rarely to affections of the cervical vertebrae, or when genuinely otitic with tenderness on deep pressure over the tip, to jugular thrombosis or to a perforation of the vaginal process, and purulent infiltration of the deeper muscles and fasciae of the neck (Bezold mastoiditis). Where either of these complications is suspected

manipulation should be extremely delicate, and as brief as possible. Here attention should be drawn to the fact that pain is normally caused by pressure immediately below the ear and just behind the glenoid fossa, and is referable to the Eustachian tube (Dench). To avoid this source of error, pressure on the tip should be made backward or from below upward. Post-mastoid tenderness, particularly if limited to the region of the mastoid emissary vein is an important symptom of sinus thrombosis or at least of the formation of an extra-dural, peri-sinuous abscess. Post-operative mastoid pain is generally slight. Marked or persistent discomfort should arouse suspicion and lead to a careful revision of the dressing, and if necessary of the operative field. Constriction by the bandage, infective cellulitis, stitch-hole abscess, retention of secretion, tight packing, are the common causes. Progressive involvement of neighboring structures due to incomplete operation or intra-cranial complications are fortunately rarer. The character of the pain in these grave cerebral affections forms a chapter of great diagnostic importance, which is, however, outside the scope of the present paper.

In a certain class of cases no organic basis for otalgia can be found, and the affection is classed among the neuralgias. Among the etiological factors of this comparatively uncommon form we have loud noise, colds, rheumatism, hysteria, neurasthenia, anæmia, malaria, diabetes, syphilis, various toxic disturbances, notably chronic lead poisoning, and finally sexual disorders, menstrual anomalies, pregnancy, the puerperium and the climacteric state, or it may be due to extreme cold (Urbantschitsch) or measles (Blau). Hysterical mastoid neuralgia may be severe and obstinate. The differential diagnosis is rarely attended with difficulties, except that severe intermittent mastoid pain is occasionally observed after spontaneous or operative cure of chronic otitis media, probably as a result of sclerosis and eburnization of the bone, and consequent compression of nerve filaments in the mucous membrane lining the pneumatic cells. Neuralgia of the concha may be accompanied by an eruption of herpes vesicles (Auriculo-temporal nerve). The external canal may be affected in neuralgia of this nerve or of the trigeminus. Tympanic neuralgia is occasionally observed.

## DISCUSSION.

DR IRA J. DUNN: That the larynx may often cause pain in the ear is emphasized frequently by the cough produced on cleansing the ear. Any and all diseases of the trigeminal may refer pain to the ear. This was further illustrated in a very recent case of antrum disease in which the aural pain caused most suffering. For several days even when the turbinates occluded the whole nasal passage with great pressure, and pain over the frontal sinus would have been most expected, the pain in the ear was most severe. Whatever affects this nerve occasions severe otalgia. Gout and rheumatism which disturb so many nerve tracts without doubt produce much otalgia. There was grave criticism at yesterday's meeting of the use of salicylates and other rheumatic medication in the relief of headache, considered due to gout or rheumatism, and we were told that proper glasses will cure every case—old medication being folly. So long as there is no mechanical device similar to glasses to increase and correct the hearing, we can likely continue medicinal treatment of these cases without fear of so severe criticism.

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## EXHIBITION OF PATIENTS.

### A Mastoid Case.

DR. BRYANT showed a patient on whom he performed a radical mastoid operation for extensive caries of the tympanic cavity a year previously. The operation had to be modified on account of the anterior position of the sigmoid sinus which approached to within .5mm. of the external auditory canal. This necessitated the opening of the antrum and the epi-tympanic space through the meatus. The blue color of the sinus can be seen on the posterior wall of the meatus.

The operator attributes the preservation of this extremely anteriorly placed sinus to the use of his front-bent gouge. On account of the small amount of bone which had been removed, he was tempted to try a new procedure with the dressing. The wound was closed posteriorly and a small amount of gauze was placed in the canal, sufficient only to distend it to its normal size.

On the 4th day the packing was removed from the meatus and not replaced. On the 6th day the posterior wound was healed and the tympanic cavity nearly dry. On the 13th day the wound behind the ear had finished desquamating. On the 22nd day there was no more moisture in the ear. On the 23rd day the enlarged tympanic cavity was epidermatized except at the mouth of the Eustachian tube. On the 42nd day the whole tympanic cavity was epidermatized.

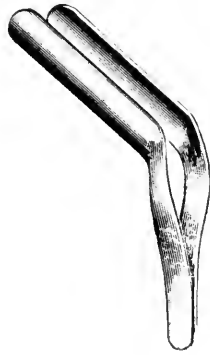
This is the first case of radical operation which has been treated according to this method. Encouraged by the short convalescence, he has tried it in eleven cases, in all of which it has worked most satisfactorily.

## DEMONSTRATION OF INSTRUMENTS.

### Nasal Speculum for Submucous Operation. Septal Bone Forceps.

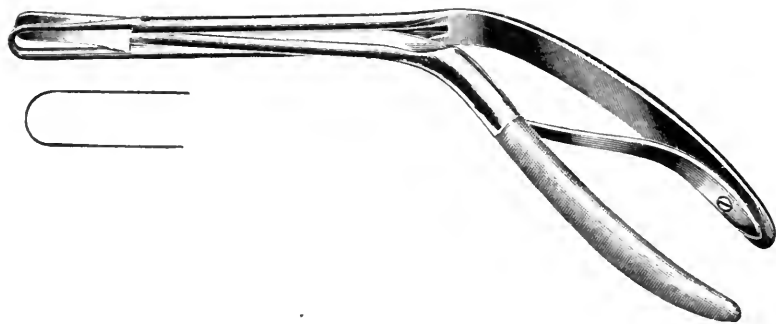
By JOHN MCE. FOSTER, M.D., Denver, Col.

The instruments which I herewith present to you will have acquired special interest on account of their use in the operation which has been so excellently presented to you by Dr. Ballenger, the "Sub-mucous Resection of the Nasal Septum."



I found that when I first commenced doing this work in January last, that the instruments at my command were quite inadequate for the work requiring a great deal of time for the operation and much patience and heroism on the part of the patient to submit to the trying ordeal; and at the completion of the operation both of us were worn out, nervously and physically. With the idea of accomplishing the same results in a very much shorter space of time and with less danger of lacerating the delicate mucous membranes and perichondrium which had been detached from the septum, I devised this speculum which is much lighter than the Killian model and I think that the slight amount of spring holding the 2 plates apart, will be found just enough to hold the perichondrium on each side well away from the septal cartilage. In this way the field of operation is well exposed, the bleeding can be controlled with swabs on tooth-picks, and the danger of lacerating the perichondrium is greatly lessened by these 2 metal plates protecting it from the instruments when introduced and withdrawn.

Dr. Ballenger's swivel knife leaves nothing better to hope for in removing the septal cartilage, but I had never seen any instrument that adequately removed the ethmoid and vomer. The best instruments at hand were some punches that removed only comparatively small bits at a time, necessitating a great many introductions and withdrawals of the instrument, consuming much time and increasing the danger of tearing the mucous membrane flaps. To overcome this difficulty and enable one to remove all the bone that is necessary in three or at the outside four bites, I have devised the bone forceps which I herewith present. This instrument not only removes quite a large segment of the bony septum at one

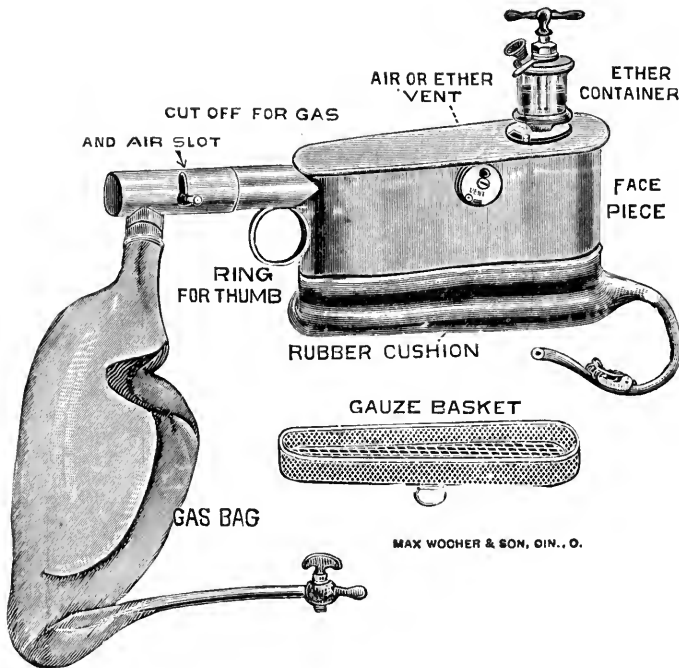


bite, but also retains the resected piece within the jaw of the forceps so that when the instrument is withdrawn, the piece of bone is withdrawn also, thereby avoiding the delay of searching in the wound for displaced piece of detached bone. In some of these cases the hemorrhage is quite continuous and fairly profuse so that it is no small matter at times to find and remove a detached piece of bone that has fallen well back toward the posterior part of the cavity. This bone forceps, I am sure, will give perfect satisfaction to any one using it. It is made by Jones, Instrument Maker, Denver.

**A New Inhaler for the Nitrous Oxid Ether Series.** By SAMUEL IGLAUER, M.D., Cincinnati, Ohio.

The apparatus that I wish to present is one that I have devised for the nitrous oxide-ether series. In its simplified form it consists of a closed, accurately fitting metal face-piece, provided with an

inflated rubber cushion. Within the face-piece is a wire basket for the gauze. Upon the top of the face-piece is a detachable glass and metal ether container from which the ether can be fed at will (modified after Brown). A short Y-piece of metal tubing

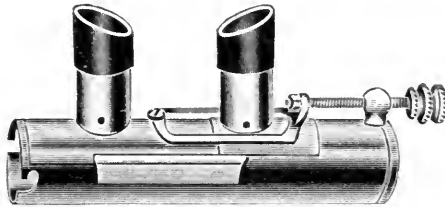


Combined Nitrous Oxid Ether Inhaler.

telescopes at one end with the face-piece. To the other end of this tubing a larger rubber bag for the nitrous oxide is attached. A small lever projects through an air slot in the tube and controls an obturator valve, which prevents the nitrous oxide from escaping before it is desired. This is the only valve in the apparatus, and acts simply as a cut-off. On the sides of the face-piece are two openings through which ether or air may be admitted if necessary. A large thumb-ring enables the anesthetist to hold the inhaler and to support the angle of the patient's jaw with one hand, leaving the other hand free.

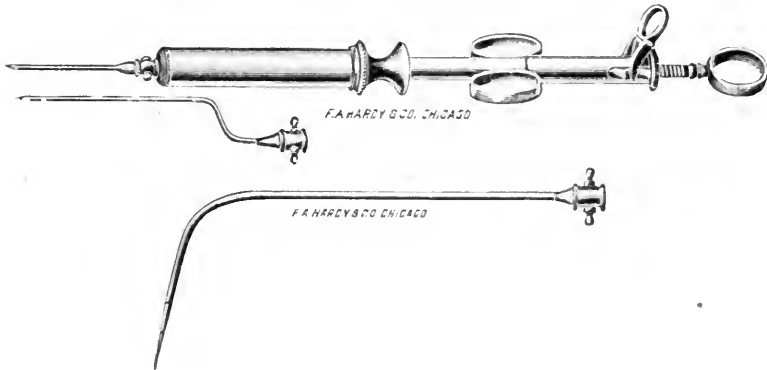
**Transilluminator. Paraffin Syringe.** By JOSEPH C. BECK, M.D.,  
Chicago, Ill.

I wish to present a specimen I presented two years ago, and yesterday when Dr. Stein read a paper he said something about it. He used the formalin with heated air. I have used this method in suppurative ear disease and find it of some advantage in using



Transilluminator.

formalin, and others have used it for this purpose. I have used this instrument, and others have also, for transillumination. It is used for transillumination of the antrum by placing this between the lips, and with electricity it gives perfect transillumination.



Paraffin Syringe.

I have studied the transillumination of the pharyngeal sinus and can perfectly illuminate both sinuses at one time by having two tubes running at right angles from the lamp to receive a uniform light and place this over the sinuses, allowing the patient to press

the head against the instrument, making two closed orifices and we receive a transillumination of the pharyngeal sinuses. It is of some advantage to do both at one time, as it is not necessary to carry the shadow in your mind. It gives sufficient intensity of light. There are two widths, which makes it fit different breadth of face.

I would also like to show an instrument I have used with some satisfaction in connection with a paraffin syringe. There are enough for this work already, but I have found this to be a little better than any I have tried, and I have used it for other purposes. I have used it for sub-periosteal injections in the ear for anaesthesia, and also for the purpose of sub-mucous resection and doing that operating comparatively bloodlessly and painlessly. This needle is for that purpose. You can inject the material drop by drop or all at one time as you please. I would recommend this for injecting eucaïne and tongalin according to Neumann's formula. Most of the syringes leak at that point and you cannot get a good grasp, but with this addition you get a firm grasp in the handle.











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